Vol. XXIV. Part 11.

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The Journal of the Department of Agriculture of Victoria, Australia.

November, 1926.

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Fallowing for Wheat
Pleuro-Pneumonia of Cattle
The Export of Fruit—Cause of Failures
Broom Fibre Growing
Poultry Feeding for Egg Production
Bees and Honey
Sherry
Planting the Potato Crop

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VICTORIA, AUSTRALIA.

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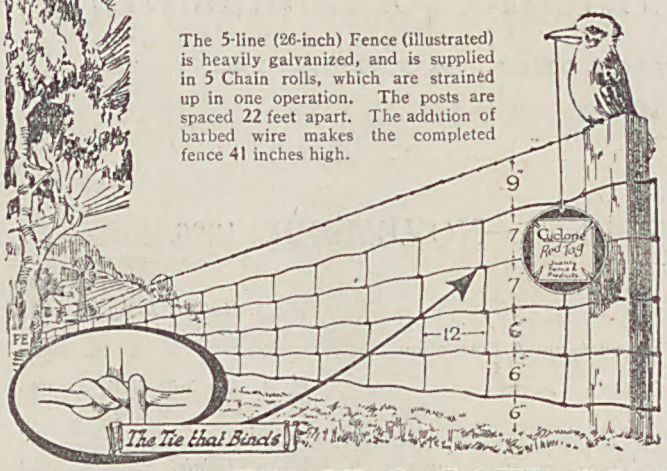

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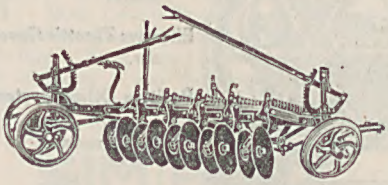

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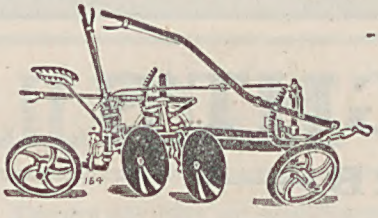

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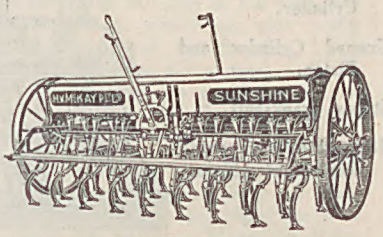

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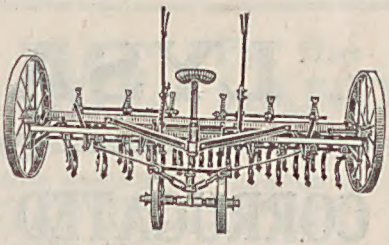

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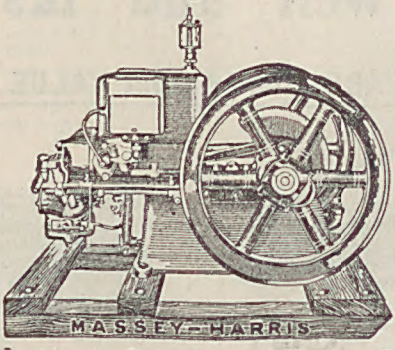

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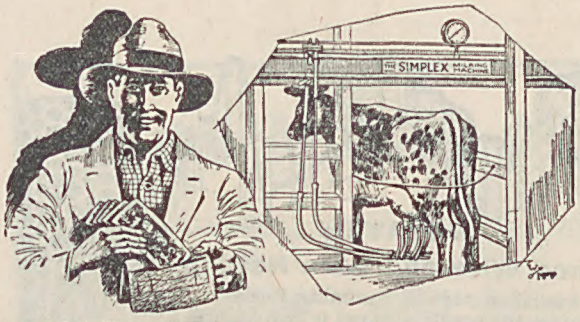

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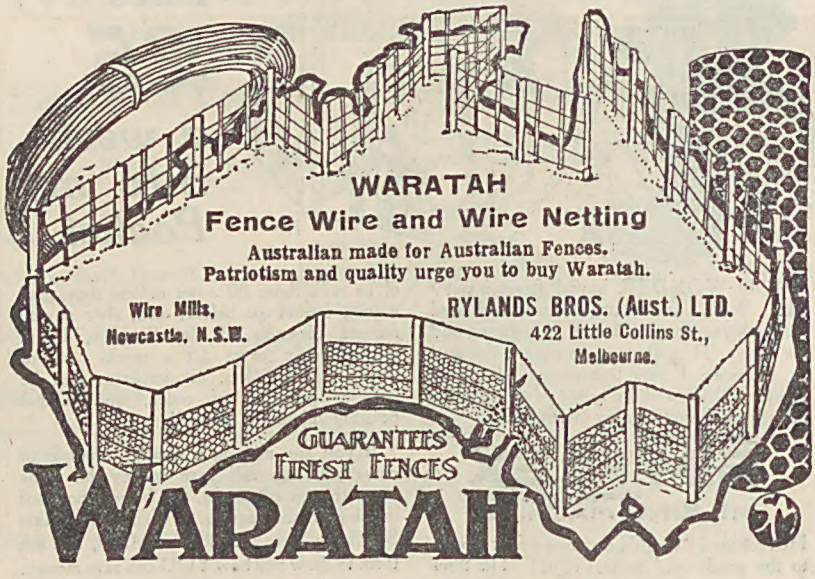

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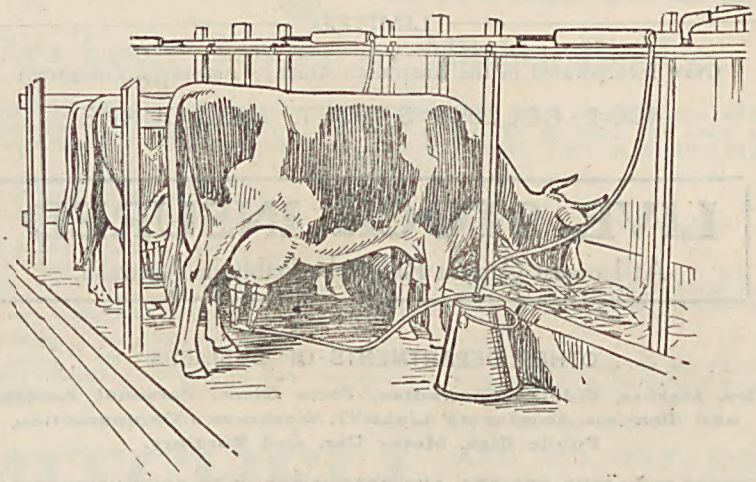

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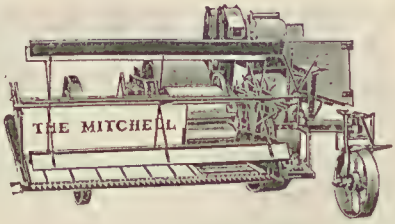

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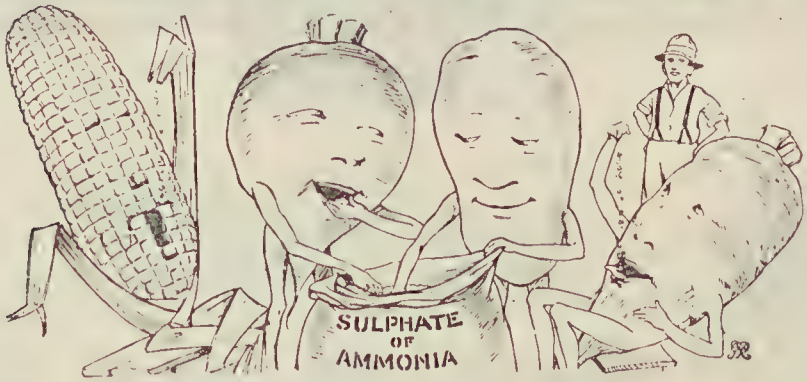

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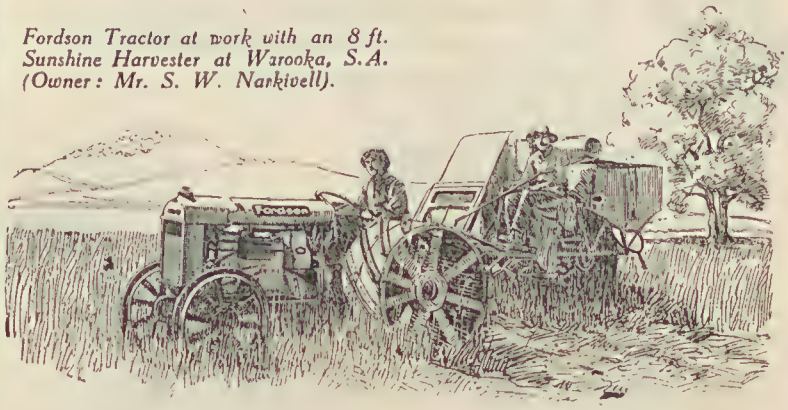

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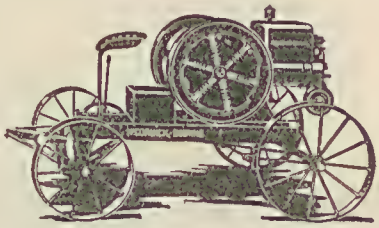

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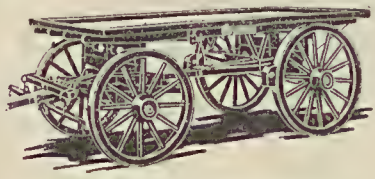

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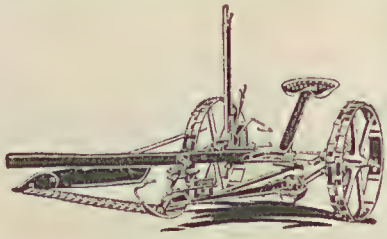

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FALLOWING FOR WHEAT.

An Address by H. A. Mullett, B.Ag. Sc., Superintendent of Agriculture, broadcast through 3LO.

In Australia, the principal wheat belt lies in that semi-arid region, about 150 miles from the coast, where the rainfall is between 11 inches and 20 inches annually—averaging, perhaps, 15 inches. It is an area which, fifty years ago, was regarded as suitable only for the hardy merino sheep. But the men who selected the land on the sheep runs were able, with the aid of the humble wheat plant, to oust the squatter permanently.

For the most part the early settlers grew wheat under conditions of which they had had no previous experience. They had to learn their business by the slow and costly process of trial and error—and many were the failures. But gradually the factors for successful wheat culture were recognized, and, with the aid of science, new methods were evolved.

The climate in the wheat belt is of the winter rainfall type; that is to say, the bulk of the precipitation takes place between the months of May and November, coincident with the growing period of the crop. The rainfall during this period, about 10 inches, is ample for wheat on soils of the physical character of those in the wheat belt, if it is regularly distributed; but, unfortunately, it is not. The winter rains, which are normally due in early April, may be delayed until the end of May, or even later; or the crop may be germinated successfully and a dry month intervene; or, more commonly, the spring rains fail.

With climatic peculiarities like this to contend with, wheat-growing could scarcely have been termed a successful and stable industry until some means had been found of providing the crop with a means of tiding over these periods of rain deficiency. Happily, this has been done, and quite simply, too. Utilizing an old farming practice, that

of bare fallowing, which dates back hundreds of years, the wheat-grower applied it in a new way. In Europe, bare fallow is largely regarded as a convenient means of killing weeds, and of converting inert soil into fresh supplies of readily available plant food, but the wheat-grower in the semi-arid regions discovered its virtue as a means of conserving moisture—of trapping rain in the fallow year, and passing it on to the growing crop a year later. Thus a kind of reservoir of moisture is created, which can be drawn on by the plant as required. Careful tests made in the summer have shown that the equivalent of 2½ inches an acre more rain can be stored in a well cultivated fallow as compared with non-fallow. Thus 10 inches of rain in the growing period of the crop becomes 12½ inches—an important addition.

Bare fallow is now regarded as of such fundamental importance to the success of a wheat crop that, in up-to-date districts like the Wimmera, no one dreams of sowing wheat except on well-worked bare fallow. Ninety-five per cent. of all the wheat sown in that district is on fallow—that is to say, 650,000 acres annually.

The success of good fallow in enabling the wheat-grower to practically defy drought was never better illustrated than last season. You will remember that the crops struggled for existence from the time they peeped over the ground. Then, in October, when they were making the biggest demands for moisture, the rains almost ceased. Twenty points was the best fall for the month in the wheat belt, and many places were rainless. But if October was bad, November was worse, for in that month there was no rain whatever for the first three weeks, and by that time the crops had practically matured. To make matters worse, devastating hot winds swept over the parched crops, and blighted many tender heads just as they emerged from the protecting sheath.

Alarmists predicted a total crop failure; others conceded that the yield might reach 10,000,000 bushels—that is to say, about one-quarter of a normal crop. But where the wheat was sown on carefully prepared fallow, it was kept growing, despite the absence of rain, by the moisture deliberately stored in the sub-soil for just such a contingency as this.

The yields surprised every one. In the Wimmera, where the rainfall for the year was little better than 9 inches, 13,000,000 bushels of some of the best wheat grown for years was harvested—an average yield of 18 bushels an acre for 700,000 acres of wheat. Thus, 3,000,000 bushels more wheat was harvested in the Wimmera than had been predicted for the whole State.

The yields in the other districts, where the soils differ, and where, perhaps, the methods are not so good, were not of the same high order, but they greatly exceeded expectations. The result of that, instead of only 25 per cent. of the normal harvest, it was over 29,000,000 bushels, or 75 per cent. of normal.

Had the same conditions existed as obtained ten or fifteen years before, the prophecies of those who predicted a crop failure would have been fulfilled, but they overlooked the marked improvement that

had taken place in farming methods, particularly in the direction of scientific conservation of moisture by correct fallowing methods.

The preparation of good fallow demands a knowledge of the principles underlying the storage of moisture in the soil, and its retention by a soil mulch; also the peculiarities of the wheat plant itself have to be taken into account. If trapping rain is the prime object of the fallow, then obviously the earlier in the year the fallow is made the more effective it is, because rain soaks into ploughed land better than it does into hard soil. It is just as important to prevent the "run off" the surface in the wheat belt as it is to encourage it in the moister parts of the State. In the dry north, it is the aim of every good farmer to catch and store every drop of water that falls on his fallow.

June fallow is better than July fallow, and July than August, and August than September. Experiments conducted by the Department of Agriculture, at the State Farm, Rutherglen, during the past six years, show that the yield on July fallow has averaged 27 bushels an acre, whereas the crop on October fallow averaged 23.6 bushels an acre, while the non-fallowed land yielded only 12.5 bushels an acre.

Since the Wimmera grower has begun to sow wheat in July instead of May, he has had to defer his fallowing until August and September —altogether too late to catch the winter rains. When summer fallowing, that is fifteen months' fallow laid down in March, was brought under his notice, he was quick to grasp its advantages, so much so that in five or six years it has become routine practice on almost every farm in the Wimmera for at least some paddocks.

Careful tests conducted by the Nhill Agricultural and Pastoral Society last year on eight farms, under the supervision of the Department of Agriculture, demonstrated that the new practice gave an average increase of 2½ bushels an acre more than winter fallow. The extra yield obtained is largely attributable to the early opening of the land in order to trap the autumn rains, though where weeds are bad, an additional advantage has accrued as a result of the practice, because it gives the farmer a better chance to completely destroy them. They germinate earlier and more readily, and hence may be destroyed by "sheeping" and by cultivation. Let me give you the slogan "Early fallow is the best fallow."

Once having got your moisture in the fallow, the next thing is to keep it there—to put the lid on as it were. Otherwise, what has been stored will tend to rise to the surface—drawn steadily upwards by the mysterious force of capillarity, only to escape into the air by evaporation. Soil moisture rises to the surface just as kerosene does in a lamp wick, and by the same force.

To reduce this loss to a minimum, the farmer must prevent the surface soil becoming consolidated, because the loss is greatest when the surface of the soil is tightly packed, and it is at least where the surface is maintained in a loose condition.

Those who do not understand the scientific principles of moisture conservation in soils often fall into the error of believing that where the surface is cemented over with a tough skin, there the moisture is best stored. Nothing could be further from the truth. Careful

tests made in the field have proved that neglected fallow is little better than no fallow. At the Rutherglen State Farm, neglected July fallow has averaged 11.26 bushels an acre as against 12.5 bushels an acre for non-fallow; yet, as has been shown, well tilled July fallow yielded 27.2 bushels an acre. It may be taken as a fundamental truth that where the soil is tightly packed, there evaporation is greatest, and vice versa.

These principles have to be modified considerably in accordance with the peculiarities of the soil treated. For instance, it is desirable to maintain a finely divided mulch of loose soil throughout the year. This may be done in the Wimmera by repeated cultivation, and so long as the soil is moist when worked, no harm can be done to the soil, no matter how often it is necessary to treat it. On the other hand, with cementy soils and stiff clay soils, such as exist in many parts of the north, the farmer dare not work down the land into a too freely divided condition, because the finer it is the more it runs together after rain, a condition which is alike bad for conserving water and for germinating grain at seed-time. On these soils, a happy medium must be struck between too fine a tilth and none at all. When fallowing land of this class, a fairly cloddy tilth should be aimed at. By judicious cultivation with tined implements, a mulch can be created which consists of a mixture of fine earth, with clods not more than a couple of inches in diameter. The tined implements tend to sift the clods to the surface, leaving the fine earth below—the best possible condition.

The depth of the original ploughing, the depth of the mulch, and the degree of consolidation of the seed-bed, that is the soil immediately under the mulch, are all of prime importance. They must be controlled to a nicety by the farmer if he desires to get the best results.

The depth to which the soil should be ploughed depends upon the class of soil. In general, the drier the climate the shallower the ploughing, and vice versa. Loose friable soils should be ploughed shallowly, and stiffer soils more deeply.

Wheat requires a firmly consolidated seed-bed. In the Mallee and Wimmera the soil is loose and difficult to compact. It should be fallowed to a depth of 3½ to 4 inches—3 inches on new Mallee land—and subsequently worked over no deeper than 2½ inches—the object being to consolidate the soil between the loose mulch and the depth ploughed.

Methods of effecting this consolidation in these districts have been brought to a fine art in the Wimmera and on the best Mallee farms. The earlier the land is ploughed, the more time it has to settle down. The more it is tilled shallowly to a carefully regulated depth, provided it is moist, the better the under layers pack. The repeated tramping of the horses helps, and sheep do their part.

The levers of the cultivating implements require careful adjustment all day long to cope with loose patches, &c. Nowadays the driver of a team, sitting comfortably on his seat, cannot afford to be dreaming of the "girl he left behind him."

On clay soils in the Goulburn Valley, and elsewhere, it generally pays to plough to 5 inches deep, provided that no sub-soil is brought

to the surface; that must always be guarded against. The same skill in effecting consolidation is not required as in the Wimmera and the Mallee, for the soils pack down naturally. On the other hand, nice judgment as to the time of working and kind of implement chosen has to be employed to maintain a mulch which will not run together on wetting.

You can form a mental picture of a perfect fallow by conceiving it to be represented by a billiard table filled to the level of the cushions with loose, mellow soil. The loose soil is the mulch, the slate is the firmly consolidated layer extending between the bottom of the mulch to the original depth of the ploughing. The surface of a billiard table is level, and so should be the surface of the seed bed, because it indicates that the cultivation has been even and regular throughout the whole field. If the seed-bed is ridged, the mulch necessarily will be of irregular depth—at one place too deep, at another too shallow. The field may look all right from a surface inspection, but you cannot deceive the wheat plant.

To sum up, the preparation and maintenance of a fallow in the Australian wheat belt is no longer done solely as a convenient method of killing weeds and of seeding a crop. No particular skill is required to do that. Bare fallow is to be regarded as a most valuable means of augmenting the meagre rainfall, and it is an insurance against drought.

To conserve the maximum of moisture requires a knowledge of the scientific principles underlying the storage of water in soil, the use of the highest technical skill, and the exercise of nice judgment. The principles have been thoroughly tested, but actual practice varies with the soil and the climate.

The slogan to adopt is "Fallow early, and fallow well; conserve the most moisture."

CORRECTION.

MULCHING FOR SOIL CONSERVATION.

In this *Journal* for last month, in a report of the Farmers' Field Day at the State Research Farm, it was mentioned that Mr. Mullett, Superintendent of Agriculture, when explaining how moisture could be conserved in the soil, said that the depth of mulching "should not be more than 4 or 5 inches." The sentence ought to have read, ". . . . the depth should not be more than 2 to 2½ inches."

PLEURO-PNEUMONIA OF CATTLE.

An Address by E. A. Kendall, B.V.Sc., Chief Veterinary Inspector, broadcast through 3LO.

Pleuro pneumonia, or "pleuro," as it is commonly called, is a contagious disease which affects cattle and cattle only. It exists in all the States of the Commonwealth except Tasmania, which enjoys complete freedom from it.

It is perhaps a little difficult to realize at first that the existence of the disease to-day in various parts of the country of such a vast area as Australia is traceable to one of five cows imported from the Old Country to Victoria nearly 70 years ago. It is nevertheless a fact.

There was no proper organization in those days for dealing with such a disease, and stock from oversea countries were not required to undergo quarantine for a period after landing as now obtains. Unfortunately, the authorities doubted the diagnosis made by a veterinary surgeon who examined this cow, and later others of the same consignment developed the disease at intervals. No adequate precautions were taken to prevent the disease spreading, with the result that other herds, and several teams of working bullocks became infected, and thus, ere very long, the disease became widespread.

It is instructive to contrast this failure to deal effectively with the initial outbreak of pleuro-pneumonia with the prompt and successful measures adopted on the occasion of the first outbreak in Australia of the dreaded disease Rinderpest amongst cattle in Western Australia three years ago. Rinderpest was completely stamped out in less than two months at a comparatively insignificant cost, and Australia is clear of it to-day. Pleuro-pneumonia, which could have been similarly dealt with at the time, is still with us after a lapse of 70 years. The loss sustained in that time may be left to the imagination.

Contagious pleuro-pneumonia is essentially a disease of the lungs. It is caused by what is termed a filtrable or invisible virus; that is to say, the germs or microbes are so small as to pass through the finest filter made, and they cannot be seen even under the most powerful microscope. Like others, these germs can be grown in a broth preparation under suitable conditions in a laboratory.

When susceptible animals are exposed to infection through an affected beast being allowed to run with them, it may take from three to eight weeks, and sometimes longer, before the disease develops amongst them. This is called the period of incubation.

Symptoms.

The symptoms of the disease are not always well pronounced at first. There may only be a rise in the body temperature. Under ordinary circumstances this is not noticed by the stock-owner, because the use of a thermometer is necessary to disclose it.

Soon after the onset of the disease the breathing becomes short and quickened; a soft, painful cough develops which will be heard more frequently if the sick animal be bustled about or given a sharp run.

In advanced cases on cattle runs and big farms the beast separates itself from the rest of the herd, stands about with back arched and

coat staring, and is disinclined to move unless driven, the soft cough being heard at short intervals.

Left to itself the disease soon spreads to other cattle in the herd, and heavy mortality may result. The spread is more rapid and extensive, and the losses greater, in dairy herds than is the case with other cattle, owing to the cows being brought more closely in contact during milking operations.

Pleuro-pneumonia is not a wind-born disease, that is to say, it does not blow from herd to herd. It is spread as a result of the close body to body contact with an affected animal. Provided there had been no previous contact, the disease would not spread to a clean herd separated from diseased cattle by two fences 30 feet apart.

Natural barriers or buffer spaces like fenced roadways, cultivation areas, plantations, &c., form effective checks on the spread of the disease. Furthermore, the causal agency of the disease does not lie on the ground or cattle enclosures. If a diseased herd were entirely destroyed and burnt, or removed from a paddock to an abattoir, fresh uninfected cattle could, within 24 hours, be safely put in the paddock from which the diseased stock had been removed.

Another noteworthy characteristic of the disease is that many affected cattle, if left to themselves, recover. It may be thought that this is something to be thankful for; unfortunately, it is not, for the animal that recovers is often a potential carrier of infection wherever it may subsequently go. Indeed, it may be truly stated that the majority of outbreaks of "pleuro" to-day are traceable to cattle which have recovered from the disease, and become "carriers."

Post-mortem Appearances of the Disease.

The post-mortem appearances of the disease are fairly characteristic. On opening the chest cavity one or other of the lungs is found to be solidified either partially or wholly. It is not common to find both lungs affected. Often a portion of the lung is attached to the chest wall, and in advanced cases a varying amount of straw-colcured fluid commonly called "virus" is found in the chest cavity or in pockets at the base of the affected lung. When the solidified lung is cut into, a reddish to brownish marbled appearance is noted. This is due to the numberless small blood vessels being engorged with blood. The double white walls which divide the lung tissue into many small areas stand out clearly, and the narrow space between them is filled with a small amount of straw-coloured fluid.

The lung of a recovered animal or "carrier" usually has a varying sized area enclosed in a thick white capsule of fibrous tissue. It is the subsequent breaking down of this capsule which leads to a fresh infection.

Measures for the Control and Eradication.

1. *Action to be taken by Stock-owner.*

An owner of cattle affected with the disease must notify the nearest Stock Inspector or the Chief Inspector of Stock. He is liable to prosecution and a heavy penalty if he fails to do so. Besides his legal responsibility there is the moral obligation to report the disease so as to safeguard other persons' stock.

Whatever justification, real or imagined, a stock-owner may have had in days gone by for not notifying an outbreak of pleuro-pneumonia, he can have none now, owing to the provisions made by Parliament for compensation being paid for cattle affected with this disease destroyed on the order of an Inspector of Stock.

Sick or suspected cattle should be promptly isolated pending an examination by the departmental officer. On no account should any of the cattle be removed until the position is determined and permission given.

2. *Departmental Action.*

The measures for dealing with an outbreak of pleuro-pneumonia consist principally of (*a*) Destruction of all diseased animals and suspects, (*b*) Inoculation of the remaining cattle in the herd, also of any cattle which are, or have been, direct contacts therewith, and (*c*) Imposition of quarantine.

Summary destruction of affected cattle and suspects is of the greatest importance, because they constitute the greatest danger of the disease spreading to other cattle. Indeed, it has frequently happened within departmental experience that prompt destruction of the first animal showing the disease, especially in the early stages, and when the herd has not been too closely confined, has prevented any further losses.

When the disease has taken a big hold of a herd and caused heavy mortality, as happens now and then on a dairy farm, it may be necessary to destroy the remainder of the affected herd. This is done to eliminate all risk of any surviving cattle becoming "carriers" and spreading the disease, as may be the case when later they are released from quarantine. Such action is taken, of course, under the provisions of the Cattle Compensation Act, so that the unfortunate owner is enabled, in some measure, to re-stock his farm and carry on.

Inoculation of contact cattle, or those which are exposed to infection, is a valuable means of affording them some protection against the disease.

The so-called natural virus from the lungs, or artificially cultivated pleuro-vaccine, is used. The inoculation is made near the tip of the tail by inserting a grooved needle charged with the virus, or by means of a large needle with woollen thread saturated with virus.

What is termed a local reaction results in from ten to twenty days from which immunity or protection against the disease is produced. This protection is not permament. It may last from six to twelve months, but cannot be depended on for a longer period. It is sufficient, however, to tide the inoculated cattle over the time the outbreak may last; provided, of course, they are not already developing the disease before the reaction to inoculation occurs. If the disease is actually developing inoculation will not check it.

Quarantine is imposed on all infected and direct-contact cattle. This is absolutely necessary to prevent movement either on or off the quarantined area—such movement might result in a serious extension of the disease. Provided no already diseased or infected cattle have been sold off or removed prior to quarantining, and the restrictions are properly observed, it is safe to state that the outbreak can be easily confined to the area under quarantine.

The obligation is placed upon the owner or occupier of the premises to keep his cattle securely fenced in. The period of detention in

quarantine depends on the circumstances connected with the particular outbreak. The minimum period is ten weeks from the last case of "pleuro." This time is needed to cover the incubative period of the disease. Occasionally a case may "hang fire" for a longer time, in which case quarantine has to be determined accordingly.

Under certain conditions it is possible for an officer in control of an outbreak to modify the restrictions regarding movement of cattle. For example, in the case of beef-cattle, permission may be given to forward them direct to an abattoir for slaughter, provided they are not showing symptoms of the disease. A dairy farmer may be permitted to bring fresh cows on to his quarantined premises to maintain his milk output, provided he can secure them from all possible contact with his infected cattle.

Again, in the case where premises, other than the place of outbreak, are quarantined on account of the owner having purchased a beast which recently belonged to an affected herd, it is possible to remove the quarantine immediately if the purchased animal be promptly slaughtered, and post-mortem examination proves it to be free from the disease.

Could the Disease be Totally Eradicated.

A question sometimes asked is, "What are the prospects of eradicating this disease completely from Victoria?" The answer is contingent on what conditions could be imposed. Given that Victoria could depend for its supply on its own natural increase in cattle, and that trade requirements could be adequately met thereby, the disease might be completely eliminated within four or five years.

Since it is necessary, however, to seek supplies of cattle from other sources, the risk of new outbreaks through the medium of stock coming into Victoria from other States, particularly the northern ones, is always present.

This risk is due to the "carrier" or recovered animal, which escapes detection at the border crossing, because there is no method of examination whereby the fact that he is a "carrier" can be revealed.

Conclusion.

In conclusion it may be advisable to mention a few points which would be helpful to stock-owners, and tend to make the control of this wasteful disease easier for departmental officers.

1. When purchasing cattle from unknown or doubtful sources in open markets, keep them isolated from other cattle, if practicable, for a few weeks after their delivery. If they develop the disease it can thus be confined to them.

2. See that cattle duty stamps are duly attached to receipts for purchase money. A claim for compensation is invalid without them.

3. Keep accurate records of sale and purchase transactions. This facilitates tracing any infected or contact cattle.

4. Report any case of "pleuro" or suspected case without delay.

5. If practicable isolate any sick or suspected cattle pending examination.

6. If any cattle have died after an illness of several days, don't bury or burn them without examining the lungs. If diseased save a portion for the Stock Inspector to see, or forward in a sealed jar or tin to the Chief Inspector of Stock, Melbourne.

When a beast that has been in good health dies suddenly, do not open the carcase. The disease in this instance may be Anthrax, which is dangerous to man.

7. Don't keep the existence of the disease a secret, and thus maybe bring trouble on some other stock-owner by selling diseased or infected cattle to him, and finally

8. Treat the departmental officer, who has to deal with the disease, as a friend and not an enemy. His job is an unpleasant one in any case, but he is just as deeply concerned for the welfare of your cattle as he is for those of your neighbour.

DRAINAGE OF ORCHARD LAND.

An Address by J. M. Ward, Superintendent of Horticulture, Broadcast through 3LO.

Drainage of the land plays a most important part in the management of the soil. To establish and increase a high productive capacity of the land is one of the oldest and most extensively practised arts of agricultural life. Most barbaric and all civilized peoples have fostered it from time immemorial.

With the vast and ever increasing demands made upon cultivated land for the growing of food for man and animal, better soil management must become more and more important as our population increases, and the small holder of land, naturally enough, gives greater attention to his small area than does the owner of broad acres.

Every producer of fruit is a small holder; his acres usually numbering from 8 or 9, to say 40 or 50, with an occasional orchardist or company having up to 200 or 300 acres. The area of the average orchard is probably from 10 to 15 acres. The orchardist, therefore, should be a small-area specialist, for his endeavour is to produce all he can from a comparatively small area.

Unless his holding is in a naturally good condition, he cannot obtain the maximum of results. In the first place, his land must be of a good soil, that is to say, it should be fairly rich in plant-food, so that it can nourish the trees and enable them to carry profitable crops of fruit over a long period of years. Each tree costs money to maintain, and if it does not return its cost of maintenance, plus a little more for profit, it becomes a liability instead of an asset. This being the case, it is the duty of the owner of the tree to see that every opportunity is given it to pay for its "board." If the soil conditions are favorable, and the tree is kept comparatively free from disease, it will do its share. Land may in several ways lose its fertility, and then the trees quickly become unprofitable to the grower. A common cause of unproductiveness in orchards is due to an excess of water remaining in the soil during the wetter months. Such superfluity should be removed by drainage. This can be done by either open drains or underground pipes.

Draining may be defined as the art of not only rendering land free from all superfluous water, but also of extracting the water before it has had time to detrimentally affect the normal growth of plants. It

follows, therefore, that all orchard land does not require artificial drainage, but only that where there is excessive moisture.

The benefit derived from underground drainage depends very largely upon the laws of nature, and every fruit-grower should keep this in mind. It is a well-known natural law that water is at its greatest density, or heaviest, when its temperature is about 40 degs. Fahrenheit. Therefore, in a body of water, that which is nearest to 40 degs. Fahrenheit in temperature will sink to the bottom, while the warmer water will float over it. The heaviest water always occupies the lowest position, and will maintain it to the exclusion of the warmer and lighter, unless it is disturbed by some force.

The main art, therefore, in the use of drainage is to draw off this cold and heavy water, so that the warmer summer fall may sink down and occupy the place of the heavy stagnant water gathered from the cold winter rains.

All soils will respond to drainage, but some more readily than others. In some, the water will take longer to find its way to the drain, but when once this is found, there will be, during wet weather and whilst the land is over-wet, a continual flow of water through the pipes.

It will easily be understood that if water is filtering through the soil into an underground drain, instead of lying on the ground both below and above the surface, the soil is benefited in many ways. It is warmer, sweeter, and better in every respect. Even on a warm eastern aspect, the soil is sometimes kept very cold by chilly water from springs, and this often accounts for dwarf or weakly-growing trees on an apparently good situation. To alter and improve this condition of affairs, it is necessary to find out the position of the spring and tap it with drains in such a manner as to convey the water away. When this is effectively done, the trees will quickly grow with renewed vigour.

There are a number of men on the land who do not appear to understand what is meant by lowering the water-level. To make this process perfectly clear, let us take, by way of illustration, a petrol tin filled with dry earth; sufficient water to saturate the soil thoroughly is added, and as the moisture gradually dries up, that in the lower part of the tin is the last to dry. Supposing, however, the soil is kept thoroughly wet, and there is no escape for the water except by evaporation from the surface, the water will become stagnant and the soil sour, and will be unpalatable to any plant growing in the tin. Owing to the process of evaporation, the immediate soil surface is not so wet as the lower soil, and the roots of the plant, not liking the sour soil containing the stagnant water, will not penetrate very far, resulting in its becoming weak and sickly. The reason for the plant's unhealthiness is the presence of acidity, due to excess of water. The natural thing, then, to do is to punch a few holes into the bottom of the tin, for the purpose of draining off this excess moisture. Thus the water-level is lowered, and the soil sweetened and improved, resulting in the roots finding more suitable surroundings and a greater range of soil from which to gather food. Now, multiply the petrol tin of earth until it becomes an acre or more, and as it is not possible to punch holes in the bottom of the soil to let the stagnant excess water out, we have to resort to other means of extracting it, hence the use of agricultural drain pipes. These

are placed to a depth of 3 to 4 feet, so that water will enter through the joints of the pipes and be carried away. Whether land can be improved by drainage is one question, and whether the operation will pay is quite another. The question as to whether it will pay depends on the value of the land before drainage, the cost of the operation, and the productive value when drained.

In the Riverside district, in Northern Victoria, there are orange groves in a heavy soil of fairly close texture, which means late-maturing fruit. Were this land thoroughly drained, earlier ripening of the fruit and greater growth of the tree would probably result.

Even on certain classes of irrigated land, underground drainage is essential, particularly where seepage and salt troubles exist.

Drain pipes of various sizes, and especially made for the purpose, are used. The pipe with a 3-inch bore is the one mostly used for laterals, with 4-inch to 6-inch, and even 9-inch, for the main drains to take the flow from the smaller pipes which form the lateral drains.

Perhaps it may be well to remind listeners-in that a 1-inch pipe carries 1 inch of water, but a 2-inch pipe carries 4 inches of water, a 3-inch three times three, or 9 inches, a 4-inch 16 inches of water, and so on.

For orchard drainage purposes, agricultural pipes are better than any other form of drains. Stone drains can be recommended, but owing to the extra amount of labour required in handling them, they are generally regarded as too costly. Wooden or slab drains have been used to a considerable extent; these, however, cannot, under any circumstances, be recommended, as the wood is a harbour for that well-known fungus disease *Armillaria mellea,* commonly called root-rot.

For a hundred years or more, drainage experiments have been carried out the world over, at depths of from 1 to 7 or 8 feet, and in nearly all instances it has been found that from 3 to 4 feet has been the most beneficial. One occasionally hears that from 1 foot to 18 inches is quite deep enough; experience has shown that underground drains at so shallow a depth carry away much more plant food than the deeper ones. From 36 to 40 inches is a far better depth at which to drain than 24 or 30 inches, because the former gives a greater range of sweet inhabitable soil. At a greater depth than from 3 ft. 6 in. to 4 feet, the cost of putting in drains is hardly balanced by the benefits accruing. The deeper the drains, the greater will be the amount of water drawn off in a given time. The roots of fruit trees do not usually penetrate deeper than the level to which the water recedes during the summer—4 feet is about the limit of capillarity; and if drains are put in at somewhere about this depth, the evaporation that keeps the soil cold is done away with.

In the soils that are affected with alkali, it may be essential to have the drain pipes even 6 feet deep for the purpose of freeing the salt from the soil.

Drainage of the soil is a big subject, entailing a great deal of work, which, of course, cannot be dealt with in this short talk.

If any orchardist, or prospective orchardist, requires further information, and will apply to the Horticultural Branch of the Department of Agriculture, we shall do our best to help him.

THE EXPORT OF FRUIT.

THE CAUSE OF FAILURES.

By G. B. Tindale, B.Agr.Sc.

All fruit shipped from Victoria to English ports is, if practicable, inspected by officials of the Agent-General's office, who furnish reports which are transmitted to the Department of Agriculture, and which often contain information of value to shippers and growers.

These reports indicate that while the conditions under which fruit is exported are fairly satisfactory, yet there is room for considerable improvement; indeed, it is generally recognized that little, if any, improvement in methods by which fruit can be landed in a sound state has been made during the last twenty years, notwithstanding a considerable advancement in the knowledge of refrigeration.

The following extracts from recent reports will give some idea of the condition in which fruit sent overseas reaches its destination:—

1926 Shipments.

Ship No. 1.—London: Pears, very variable condition; some worthless.

Ship No. 2—London: Pears, carried with apples, were in many cases overripe and wasty. Apples, Cleos., 11s.—16s., Jons., 7s.—16s. (Prices suggest great variation in condition of fruit.)

Ship No. 3—Bremen: Apples—The Victorian fruit was not quite sound in condition.

Ship No. 4—London: Apples—Fair condition on the whole, some few parcels showing spot and some waste. Cleos., 10s. 3d.—15s. 3d.; Jons., 7s.—14s. Grower A—Very wasty; grower B—Showing waste; grower C—Very wasty; grower D—Some wasty and spotted. Pears—A number of cases were very wasty and worthless. Grower A—All wasty; grower B—All wasty; grower C—Wasty and useless; grower D—Very wasty, mostly useless; grower E—Very wasty, mostly useless.

Ship No. 5—Hamburg: There were only a few lots of Cleos., Dunns, and Jons. of really prime, clean quality. About 1,000 cases of this cargo were of very inferior quality, and discharged with a great percentage of deterioration. The general condition of the cargo turned out to be rather ripe, and a good many lots showed more or less waste.

Ship No. 6—Liverpool: Apples—Grower A—A few bruised and wasty, some showing bitter pit; grower B—In bad condition showing waste; grower C—Jons., some showing waste.

Ship No. 7—London: The fruit on this boat arrived on the ripe side. Apples—Jons., 5s.—13s.; Cleos., 6s. 6d.—14s. Pears—All pears were very wasty. Grower A—Wasty and valueless; growers B, C, D. and E —Overripe and wasty.

Ship No. 8—London: Great variation in price owing to some being marked with bitter pit. Fruit was of fair quality. Grower A—Wasty and pitted; grower B—Badly pitted; grower C—Wet, wasty, and pitted; grower D—Ripe and spotty; grower E—Very wasty.

Ship No. 9—London: Apples generally in good condition. Jons., 7s. 6d.—12s.; Cleos., 10s.—15s. 6d.

Ship No. 10—London: Apples generally good. Grower A.—Badly pitted; grower B—Very wasty; grower C—Very wasty.

Ship No. 11—London: Apples—Grower A—Wasty condition; grower B—Wasty and valueless. Pears—General condition, many bad.

Ship No. 12—Southampton: Apples—Arrived in very fair condition. Grower A—Badly marked with bitter pit. Pears were overripe and wasty.

Ship No. 13—London: The apples were in a ripe condition.

Ship No. 14—Hamburg: The whole cargo landed overripe and wasty. Even among the best lots there was hardly any case which did not hold at least a few rotten apples. Some pears had to be destroyed.

Ship No. 15—The fruit was generally overripe and wasty. Cleos., 4s.—10s. 6d.; Jons., 6s.—11s. 6d.

Ship No. 16—London: Apples arrived in a good, hard condition. Grower A—Spitzenburg, very wasty; grower B—Jonathan, overripe and wasty.

Ship No. 17—London: Fruit arrived in fair condition. Jons., 7s. 9d.—9s. 6d.; Cleos., 7s.—8s. 3d.

Ship No. 18—Hull: Fruit arrived in very fair condition.

Ship No. 19—London: Fruit generally overripe and wasty. Cleos., 4s.—10s. 6d.; Jons., 6s.—11s. 6d. Grower A—Jons., overripe and wasty. 4s. per case; grower B—Jons., some overripe and wasty; grower C—K. David, wasty; grower D—Rymers, very wasty; grower E—R. Beauty and Statesman, wasty; grower F—Statesman, wasty.

Ship No. 20—London: Pears—Carried in special chamber and arrived in good condition. Apples—Grower A—Jons., overripe and wasty; grower B—All fruit in bad condition and badly packed; grower C—Spitzenburg, poor and wasty; grower D—K. David, some overripe and wasty.

Ship No. 21—London, Liverpool: Apples—Grower A—Monroe's Fav. and Dunn's in bad condition; grower B—Dunn's, wasty; grower C—Jons., in poor condition.

Ship No. 22—London: Apples—Grower A—Some cases damp and wasty, 1s. 6d.; grower B—Jons., some cases very wasty and valueless; grower C—Jons., 3 inches, all bad.

Ship No. 23—Glasgow: Apples—Grower A—The whole pack was overripe and wasty; grower B—Jons., 2¾ inches, fully ripe, some wasty; grower C—London Pippin, 2¼ inches, fully ripe, some wasty.

1925 Shipments.

Ship No. 1—London: Some Jons. overripe and wasty.

Ship No. 2—Liverpool: Apples—Grower A—K. David, overripe and wasty; grower B—Jons., soft and wasty; grower C—Jons., overripe and wasty.

Ship No. 3—London: Pears—A few cases were overripe and wasty.

Ship No. 4—London: Apples, arrived in fairly good condition. Grower A—Jons., wasty; grower B—Jons., wasty; grower C—Jons., overripe and wasty. Pears, many were defective.

Ship No. 5—Hull and London: Pears, very bad condition, mostly overripe and wasty.

Ship No. 6—Hull and London: Pears, Keiffers were wasty on this boat. Apples, K. David, from grower A, were very wasty and in bad condition; Rokewood from grower B were in a very bad condition.

Ship No. 7—London: Pears, in many cases overripe and wasty. Apples: Growers A, B, C—London Pippin, Jons., overripe and wasty.

Ship No. 8—London: Pears, overripe and wasty.

Ship No. 9—London: Pears, very bad condition, mostly overripe and wasty. Apples—Grower A—Spotty, overripe, and wasty.

Ship No. 10—London: Apples—Grower A—London Pippin, overripe and wasty; grower B—K. David, very poor condition, some wasty; grower C—Rymers, overripe and wasty; grower D—London Pippin, some overripe and wasty. Pears—Growers A, B, C, and D—Pears overripe and wasty.

Ship No. 11—London: Fruit good with the exception of some overripe and wasty packages.

Ship No. 12—London: Apples—Growers A, B, and C—Fruit overripe and wasty.

Ship No. 13—London: Apples, some were in an overripe and wasty condition.

Why Shipments are so Often a Failure.

A perusal of these reports shows that in the case of apples the results are only mediocre; at times they arrive in very good condition; at other times their condition is such that the amount they bring leaves no profit to the grower; indeed, on occasions there has been considerable loss. With regard to pears the results are deplorable; they generally arrive in an overripe and wasty condition.

Growers naturally ask why is it that the export of their fruit, involving a storage period of six to eight weeks, is attended with such grave risks, while the same kinds of fruit may be held here in cool store in excellent condition for periods of several months. The reason, however, is not hard to find. Our fruit is picked at a warm time of the year, when it is ripening very quickly. If it is not cooled soon after being picked, the ripening continues at a rapid rate, and in the case of apples it is only the matter of a few weeks, and with pears a few days, when they reach an overripe condition, and hence their market value is materially decreased.

Even should the fruit be cooled before this state of overripeness is reached, it is obvious that the remaining life is very limited, and such fruit will very readily break down in cool store.

That delay between picking and cooling greatly reduces the cool-storage life, and is responsible for rapid deterioration on removal from store, is a very well-known fact.

Fruit stored here is generally cooled down within a day or two after picking, with the result that both apples and pears are kept in excellent condition for periods extending over several months; it is, in fact, very rare for growers to make complaints regarding the efficacy of local cool storage.

Contrast this state of affairs with that prevailing in the export trade. After picking, the fruit has to be graded and packed (for local storage this operation is suspended until the fruit is removed from storage). When packed, it must be carted to the railway, loaded into trucks, and then forwarded to the ship's side, where further delays are liable to occur before the fruit is actually transferred to the ship's chamber.

While lying in the packing shed and during transport to the ship the fruit is liable to become very hot, for the sun striking the iron roof of the packing shed or the iron trucks makes conditions within unpleasantly warm. Then again, owing maybe to the postponement of sailing of the ship, or the too early arrival of the truck at the ship's side, the trucks are sometimes kept standing in the sun for a considerable period. When a truck of this sort is opened, sometimes the hot fumes compel the wharf labourer to stand away from it for a quarter of an hour or so. An examination of the fruit will show that it is already seriously damaged, and various ships' engineers have bitterly complained of having to accept such consignments. Thus it will be seen that generally a period of a week or more elapses between picking and loading into the ship's chamber, by which time fruit transported during warm weather has reached an advanced stage of ripeness.

However, even when once in the ship's chamber, the fruit is still at a severe disadvantage compared with fruit loaded direct into a land store.

In the land store, a few hundred cases on being placed in a chamber are cooled down within a day or so, for they are not only cooled by the cold circulating air, but also by the great bulk of cold fruit already in store. Conditions, however, are very different when fruit is loaded into a ship's hold. The ship's engineer has not only to cool down a great bulk of closely-stacked cases, but has also to remove the enormous amount of heat developed by such a mass of fruit during the process of respiration. This is an important consideration, and one often overlooked. Even after picking fruit is still living, and continues to respire, oxygen being taken in and carbon di-oxide being given off, and in the process heat is developed. The rate of respiration is proportional to the temperature of the fruit itself, as is shown in the accompanying graph. Under ordinary conditions, the heat is dissipated into the surrounding atmosphere, and is, therefore, not noticed, but in a closed insulated chamber (i.e., under adiabatic conditions) the heat accumulates.

Consider, say, a shipment of 80,000 cases of fruit loaded at 68 deg. F. A glance at the graph (page 657) shows that in the course of 24 hours the fruit will gain no less than 8 deg. F. Allowing 40 lb. per case, and a specific heat of .8, the gain of heat by the fruit is shown by the calculation below:—

$$40 \times 80{,}000 \times .8 \times 8 = 20{,}480{,}000 \text{ B.T.U. per 24 hours.}$$

$$1 \text{ ton refrigeration} = 318{,}080 \text{ ,, ,, ,,}$$

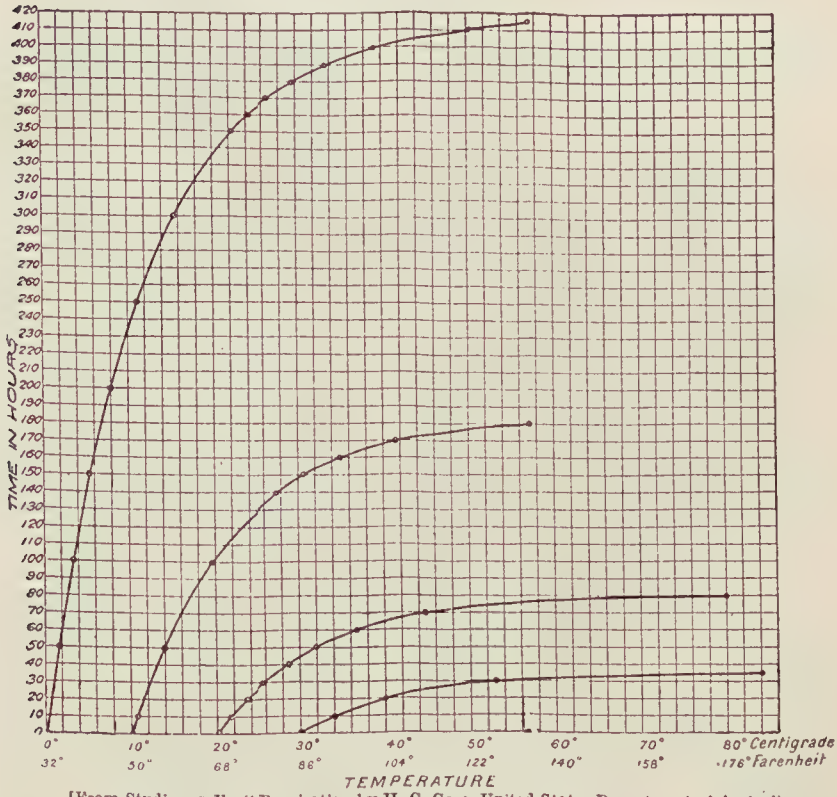
$$\text{Hence refrigeration tonnage to remove heat} = \frac{20{,}480{,}000}{318{,}080} = 64 \text{ tons refrigeration.}$$

Only the refrigeration power in excess of this amount would then be available for cooling the fruit. Thus it can be understood why it takes so long for the fruit to be cooled down after being loaded into the ship's hold; indeed, a study of the temperatures at which it is carried shows that in general it takes about a fortnight to three weeks after loading for the whole bulk of fruit to cool to a temperature of 34 deg. F. Even where there is ample power, the process of cooling cannot be carried out very rapidly, on account of the fact that the incoming air must not be below 28 deg. F., otherwise the fruit nearest the inlets would be frozen.

If the period required for cooling the fruit on board ship be added to the period which elapses between picking time and loading time, it will be seen that in many cases a period of weeks elapses before the temperature is sufficiently reduced to retard ripening.

Is it any wonder then that pears exported under such conditions are almost invariably wasty and overripe when they reach their destination, while apples frequently arrive in an unsatisfactory condition?

How, then, are we to overcome the problem?



[From Studies on Fruit Respiration by H. C. Gore, United States Department of Agriculture.

Theoretical Rate of Increase in the Temperature of Fruit held in a Closed Insulated Hold, i.e., under Adiabatic Conditions.

Pre-cooling an Essential.

This may be quite simply done by the growers sending their fruit to the cool store as soon after picking as possible. Expert packers could be engaged at the cool stores by the growers (either individually or co-operatively), thereby saving the grower a lot of bother at a very busy period. The fruit could then be cooled to the required temperature within a couple of days. After being cooled it should be sent direct from the store to the ship's side in insulated trucks. Should delays occur before loading, no damage would result, as the temperature would rise only a few degrees.

Once on board ship, the maintenance of the low temperature would be quite simple, for not only is the fruit already cooled, but at such a temperature respiration is practically at a standstill, and hence very little heat would be developed by the fruit itself.

This is also a very obvious way of overcoming "Brown Heart" in the case of apples, for with the almost total cessation of respiration there would be little evolution of carbon di-oxide, and, therefore, dangerous accumulation of this product would not occur. It seems to be a remarkable thing that, while many people are clamouring for the installation of carbon di-oxide recorders in the holds of ships, the Local Cool Stores Association has never suggested that such an instrument would be desirable in their own stores. This is simply due to the fact that in land stores the fruit is quickly cooled to a dormant condition, and, therefore, no serious accumulation of carbon di-oxide occurs.

By pre-cooling in such a manner, every case should arrive at the overseas markets in a perfect condition, provided, of course, that the fruit be picked at the proper stage of maturity. Also such a scheme would permit of that absolute uniformity in grade (as well as quality), a factor which is indeed a very pressing one. This could be attained by the packers at the various stores packing to certain standards, which may be mutually agreed upon. If such conditions were brought about, it would then be possible for a European buyer to order, say, 500 cases of choicest-grade Victorian Jonathans without inspection. Needless to say, under such conditions the fruit would practically sell itself.

Just here I may mention a statement of Mr. A. R. T. Woods, General Manager, Nelson Line of Steamers (*Ice and Cold Storage*, September, 1926, page 234) emphasizing the necessity of pre-cooling before loading into the ship. He states that where fruit is despatched by rail in Canada, it is pre-cooled, the wagons also are pre-cooled, and the temperature is maintained at a more or less uniform figure.

The cost of pre-cooling is about 3d. per case, but if the scheme were placed on a well-organized footing, numerous small savings could be effected which are not open to the growers at present, each dealing individually.

For most exporters the additional cost would not be 3d. per case, because most have space allotted to them in the local cool stores, which space could be utilized at a period of the year when otherwise it would be vacant.

Growers not convenient to a cool store could forward their fruit to Melbourne for pre-cooling. In regard to pears, several growers who have had consistent success over several years always adopt the process of pre-cooling as soon as possible after picking.

In conclusion, I would like to point out that our growers are certain to meet with very serious competition from South Africa and Argentina in the near future. South Africa, in its effort to export its fruit under the best possible conditions, has recognized the necessity of pre-cooling before shipment, and has recently erected an up-to-date pre-cooling station at Cape Town. South Africa has the advantage over us that a journey from there to England takes only half the time required for the journey from here. This makes it all the more necessary that we should adopt pre-cooling in order that we may be able to compete at least on equal terms with our rivals.

BROOM FIBRE GROWING.

An Address by Temple A. J. Smith, Tobacco Expert, broadcast through 3LO.

The growth of broom millet in Victoria for the purpose of providing material for manufacturing what are called American house brooms is one of the smaller industries, which should be of value to holders of limited areas of suitable land, especially where irrigation is possible.

The recent prohibition of the importation of foreign fibre for broom making, owing to the danger of introducing the dreaded corn borer, has led to a keener interest in the crop, and an association of broom growers throughout the eastern States of the Commonwealth has been formed to control the industry in the growers' interest.

That good quality millet can be grown in Victoria has been amply proved, and a sample of 1 ton sent to the Franco-British Exhibition, in 1912, was very favorably commented upon. At the present time, the area under cultivation in Victoria is approximately 1,600 acres, and the greater part of the raw material is produced in the north-eastern portion of this State, along the Ovens and King River valleys, while smaller quantities are grown on the Upper Goulburn and other river flats, where the summer rainfall is good.

Broom corn belongs to the Sorghum family, and differs from other plants of the Sorghum group in having the seed borne on long, straight, fine branches or panicles, which constitute the brush from which the brooms are made. It is said that the broom corn type originated in Italy some 1,800 years ago, and was evolved by the continual selection of heads that bore the longest branches or panicles.

There are two recognized varieties of broom corn, known as the Standard and the Dwarf. The Standard type, which is the variety chiefly grown here, reaches a height of from 10 feet to 12 feet, and produces fibre from 16 to 26 inches long, and is used for making carpet brooms. The Dwarf type grows a leafy stalk 6 feet in height, with a brush 10 to 18 inches in length; this variety is used for manufacturing whisks and brushes for clothing and lighter work.

Good broom fibre should be of suitable length, fine, straight, tough, elastic, and of light-green colour. Brittle fibre of brown or red colour, with coarse texture and branching heads, is of low value. The growing of this poor quality material can be guarded against by using good seed and by good cultivation and proper methods of handling the crop.

The Soil and Climatic Conditions Necessary.

The soils best suited to the production of good broom fibre are the rich river flats, especially those which contain a good percentage of sand, but the Dwarf variety can be grown on rather lighter soils and with less rainfall. Climatic conditions are of quite as much importance as the soil. Being of sub-tropical origin, the crop requires a warm sunny climate, with sufficient rainfall to induce rapid healthy growth in the early stages.

It is essential that harvesting be done during dry weather, so as to allow the brush to cure quickly and retain its green colour. Too

much rain during the ripening season will cause the fibre to turn red, and add materially to the labour and cost of handling the crop.

A rainfall of 24 inches to 36 inches per annum, with a dry February and March, is as nearly ideal as can be desired. Irrigation can, with advantage, be made to supply moisture when the rainfall is deficient. Generally speaking, the soils and climates which are suitable for the production of maize are suitable for broom fibre.

Cultivation.

Cultivation for this crop must be thorough and deep. Winter fallow and constant working of the land is desirable, so as to get rid of weeds and conserve moisture. The young broom plant makes very slow growth for several weeks after it is planted, and if weeds are numerous the crop is liable to be choked, and a great amount of labour will be required to save it.

The seed bed should be worked down to a fine mellow condition; lumpy ground is wholly unsuitable for broom corn. The usual sowing time is in November, but, should the season be wet and cold, it is wise to wait until the soil is warm enough to quickly sprout the seed, otherwise the germination will be poor, and a fresh seeding be necessary. The seed is sown in drills 3 feet to 3 ft. 6 in. apart and 6 to 7 inches in the rows. If thicker than this the plants will need to be thinned out.

Seed.

The importance of using good seed cannot be too strongly emphasized, since the quality of the fibre and brush depends largely upon the quality of the seed. The grower of broom corn, when starting, should obtain his seed from an experienced farmer who makes a practice of selecting his seed carefully each year. His requirements for subsequent seasons should be selected from his own crop from plants true to type that show fine, straight, and long panicles. Heads that show thick centre stems and crooked fibre should be avoided, and also plants that ripen late. The seed should be gathered just before the plants ripen. A separate seed plot in which the best selected seed is sown and again selected each year is a good proposition, and will lead to better crops and better quality.

The seed should be well cleaned and stored in a dry place, where rats and mice cannot damage it, until required. Pickling the seed in a 2 per cent. solution of bluestone is a means of preventing smut, and this should be done immediately before sowing. Some growers sprout the seed prior to sowing, but little is gained in this way, and, unless the soil condition is good, the practice is not recommended. Three lb. of seed per acre is sufficient; to sow thicker merely entails more work in thinning out. A crop that is grown too thickly will yield shorter fibre of low value, and increase the cost of production. Care must be taken not to sow too deeply. On sandy soils an inch is the right depth; on clay soils half an inch is deep enough. If equipped with special plates, the maize planter can be used for seeding. A wheat drill can be made to sow broom seed by closing the drill vents to allow only the required hoes to work, so spacing the rows.

Fertilizing.

No matter how good the soil may be, it will pay to fertilize. The use of superphosphate at the rate of 2 cwt. per acre will increase the length of fibre, improve the seed, and cause the crops to ripen quickly. Some growers assert that three to four weeks' work can be saved by using superphosphates in sufficient quantity. On soils not so rich 100 lb. of blood manure or sulphate of ammonia, and 100 lb. of sulphate of potash, in addition to 200 lb. of superphosphate, will be of great benefit. The fertilizers should be applied a week or two before the seed is sown. They may be applied with the seed, which will mean a saving in time and trouble, but this is not quite as beneficial a practice as the application a couple of weeks earlier.

Care of the Growing Crop.

When the young plants have taken a good grip of the soil inter-cultivation begins, and is continued until the crop is 4 feet high, so as to keep the weeds down and the soil loose. Some hand-hoeing and weeding may also be required, as weeds must be kept under if the crop is to be successful. The more experienced growers do not advise inter-cultivation after the crop is 4 feet high, as the surface roots are liable to injury and more harm than good will result.

Harvesting.

Harvesting is probably the most costly work in producing broom fibre. To get good green colour and tough fibre, the plants should be harvested while the seed is in the milk stage; if allowed to ripen fully, the colour will be yellow and the fibre brittle.

As standard broom corn grows from 10 to 12 feet in height, it is tabled before cutting, the operation being performed by a man going ahead of the cutters and bending down two rows in every six across each other in such a way that the stalks are kept about 2 feet from the ground. One man can table as fast as two cutters can take the heads off. The cutters release the heads from the sheath. Where the fibre is 22 inches and over, 4 inches of stalk is allowed; where the fibre is from 18 inches to 22 inches, 6 inches of stalk is cut; and where the fibre is from 8 to 18 inches the stalk should be 10 inches. As the heads are cut they are kept straight and laid in layers upon the table made by bending the stalks over. No rain should be allowed to touch the fibre once it is cut. Should wet weather threaten, the fibre should be taken to the shed and spread thinly on batten floors to dry out, a process which takes six to seven days. Should no rain fall, the fibre may remain in the field and dry in two or three days; then it can be bulked in heaps in the shed. Care must be taken to have the heads dry enough to obviate all risk of the bulks heating or becoming mildewed. A shed 24 feet long and 16 feet wide and 10 feet high will accommodate the fibre produced on from 15 to 20 acres.

Grading.

Grading the fibre into three or more grades is not insisted upon by Victorian manufacturers, and an agreement has been entered into between the Broom-growers' Association and the buyers that the basis

of marketing should be what is known as a self-working sample, such parcel to consist of 40 per. cent. long hurl, 25 per cent. covers, and 35 per cent. insides. In order to settle any difference of opinion which may arise on this question, samples of the three grades have been selected, and are held by representatives of the growers, the manufacturers, and the Department of Agriculture as the standards on which the fibre is to be purchased.

Threshing.

Threshing the seed from the fibre is performed by holding several heads by the butts, and placing the seed ends on a revolving roller, studded with 4-in. spikes. The heads are turned once, and the seed is easily removed, after which the clean fibre is tied in bundles 9 inches in diameter, and again bulked until baling time.

The seed must be kept dry, and later should be well cleaned through a winnower, when it can be bagged and is saleable as feed for fowls and pigs, and as winter feed for horses. Prices range from 2s. to 5s. per bushel, and an average crop will yield four to five bags per acre.

Baling.

Practically all the broom fibre grown in Victoria is marketed in bales. The press in which the bales are made is a collapsible box 42 inches long, 24 inches wide, and 48 inches high. The press is placed upon a level surface, with wires to the number of five across the bottom, the outside wires at least 8 inches from the end of the bale. The fibre is laid lengthwise in the box, keeping the butts to the outside ends in each case until the box is filled. A false lid, which fits inside the box, with battens nailed across, is put on, batten side down, and a lever screw, or any convenient pressure, applied until the bale is pressed down to about 2 ft. 6 in. The sides are then released and the wires twitched tightly round the fibre, when the bale is completed. No. 8 wire is considered the best gauge to use. It is a mistake to make the bales too large, as they do not carry well, and the dimensions agreed upon are 42 inches by 24 inches by 30 inches. All growers are urged to adopt this scale, which suits the railways for trucking, the manufacturers for storing, and is a generally useful size for handling. Bales should weigh from 150 to 200 lb., according to the amount of pressure used.

Yields, Prices, etc.

The average yield of a crop of broom corn over a period of years is 5 cwt. per acre of fibre, and of seed 9 bushels per acre, though in good seasons crops have given 12 cwt. of fibre and 18 bushels of seed.

A minimum price of £50 per ton of fibre has been agreed upon between the Broom-growers' Association and manufacturers for good fibre up to the standards selected, while prices have been paid recently up to £70 per ton.

It is estimated by growers that the cost of production is £40 per ton; consequently the crop should be a payable one, provided good-quality millet is offered. The stalks are of some value after the crop has been harvested for fodder, and make very good silage, and the sale of seed helps to increase the profit.

The Market a Limited One.

Owing to the prohibition affecting the importation of foreign broom millets, local growers find it incumbent upon them to produce fibre of the best quality and in sufficient quantity for manufacturers' requirements. That they can do so there is no doubt. While the manufacturers have met the producers fairly, and state that they are satisfied that Australian broom millet can hold its own with that of other countries, a note of warning is necessary here. At present Victoria could easily produce more fibre than is required for local consumption, and some step will have to be taken by the Broom-growers' Association to regulate production in order to avoid a glut. The industry is one that requires careful handling, and will probably expand as our population increases. The outlook for an export market cannot be called promising, as the freight and cost of production of the locally-grown broom fibre would be seriously handicapped in competition with the Italian and American.

The Victorian Department of Agriculture has for distribution a pamphlet on broom fibre culture, which can be obtained upon application.

STACK ENSILAGE.

By G. E. York, Dairy Supervisor.

Travelling through the various dairying districts of this State, one cannot fail to notice how few farmers take the precaution of making ensilage as a safeguard against fodder shortage.

When questioned as to why a certain crop is not to be preserved in this way, the answer is in many cases—"The expense would be too heavy. A silo alone would cost me £100."

This is quite true, and, therefore, it may be worth while describing how it is possible to make ensilage from maize or other suitable crops, without going to the expense of building a silo and purchasing a powerful engine, a chaff-cutter, and an elevator. Sufficient evidence that good ensilage can be made without a silo may be seen on the farm of Messrs. Gibson Bros., of Trafalgar. Some time since these gentlemen founded a promising Jersey stud, and of late years the names of "Leathorn" Jerseys have frequently occupied a place well up in Government Herd Test records.

As well as breeding and "weeding," the Gibson Bros. have realized the necessity of feeding if success is to be attained. It is usually in the winter months that the pinch is felt, and it is then that a supply of succulent fodder such as ensilage is most appreciated. Consequently each year the month of April or May finds them busy making stack ensilage. As the district is particularly adapted to maize growing, this crop is generally used, but millet has also been successfully treated.

The method is simplicity itself. As would be the case if a silo were to be used, the work is begun when the crop has reached just that stage of dryness when the leaves have lost most of their sap, but while the main stalks and cobs are still fairly green and heavy. As in any silage making, the greater the pressure and consequent exclusion of air, the better the result will be. But in making stack ensilage, instead of

depending on any great height to give the desired pressure, the simplest method is to weight the finished stack with logs and earth, as shown in Fig. 1.

First of all two parallel rows of stout sapling poles are erected, being planted in the ground about 3 feet. To prevent them from spreading under the weight of the stack, these poles are wired together, either on a level with the ground, or high up so as to be out of the way during stacking operations. The poles should be about 3 feet apart, but the distance between the two rows, and the size of the stack must be determined by the amount of crop to be treated. About 52 cubic feet of good ensilage will be about a ton, so by cutting, say, a square yard of the crop and weighing it, an idea can be formed as to the total amount of ensilage the crop will yield. The aim should be to have the finished

Fig. 1.—A Stack of Maize Ensilage containing about 150 tons.

stack as high as possible. It must be remembered that it will settle down considerably, even before the weights are applied, and to ensure having a finished stack, say, 10 feet high, it should be about 15 feet high at the completion of stacking. Therefore, the mistake of building the stack on too big a foundation and letting it settle down to a height of only 2 or 3 feet must be avoided. In that case the percentage of waste would be too high for the work to be profitable.

With the poles in position, the cutting and carting may begin. As Messrs. Gibson Bros. usually have a considerable area under crop, the cutting is done with the reaper. The maize is simply stacked longitudinally between the poles. The work need not be unduly hurried, as the stack is settling down all the time, and an occasional shower of rain

is not at all detrimental, particularly if the crop has become a little bit dry.

When all the maize has been carted, the ends of the stack are trimmed down with a broad axe, leaving a solid face, and the loose ends are placed on the top. Weighting down is the next step, and this is done either by placing logs or posts round the outside edge of the top of the stack, and then throwing earth over the top of the stack, or, if sufficient timber is available, this alone may be used. The amount of waste in a well-made stack of ensilage is small—no more than a depth of six inches round the sides having to be discarded.

In the background of Fig. 2 a concrete silo will be seen. Messrs. Gibson Bros. state that for several years now this has been unused. They find that the slightly higher percentage of waste in the stacking method

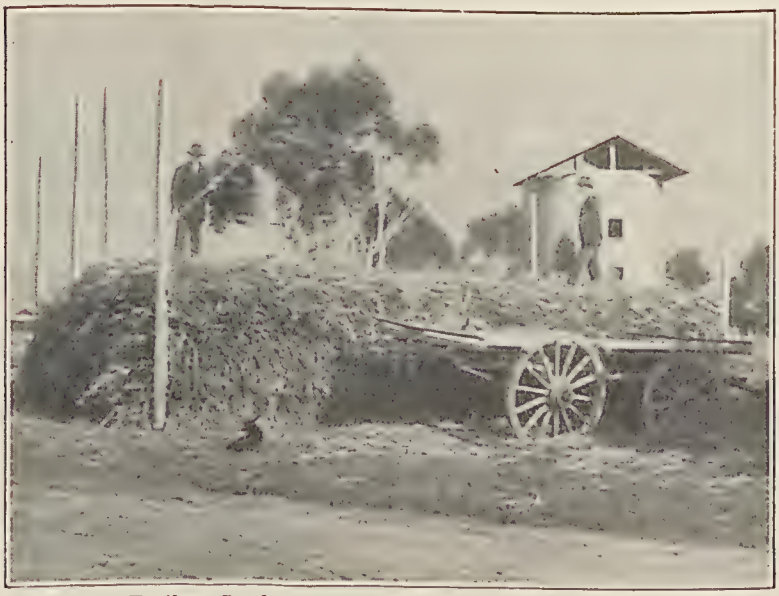


Fig. 2.—An Ensilage Stack in course of construction on the farm of Messrs. Gibson Bros.

is easily counter-balanced by the much quicker handling of the crop. They do not claim that stack ensilage is better than that made in a silo, but they mention the following points in its favour:—

1. The stack may, if desired, be made where the crop is grown, thus saving transportation difficulties.

2. Any waste from the stack may easily be spread over the land again to act as a fertilizer when turned in at the next plowing.

3. The stacking method gives the small farmer of limited means an opportunity to preserve a crop without a big outlay.

4. When opening a stack of ensilage, a small section of the top only need be uncovered, and may be worked right to the ground before any more of the top is exposed, whereas in feeding from a silo the whole surface must be worked at once, which means greater waste through exposure to the air.

FEEDING POULTRY FOR EGG PRODUCTION.

By W. C. Rugg, Chief Poultry Expert (broadcast through 3LO).

The subject of poultry foods and feeding is one of vital importance to all poultry-keepers, more especially to those keeping fowls for egg production.

Success in the business depends on getting birds to lay the maximum number of eggs at the minimum cost for food. The three essential points to be looked for in poultry feed are purity, variety, and cheapness.

Pure Wholesome Food Necessary.

It is surprising how many people have the idea that any poor quality grain is fit for fowls—a belief just as common in rural districts as in Melbourne. How often is a farmer heard to say when inspecting an inferior sample of grain, "Oh, it's good enough for fowl feed." Well, I can assure those who want to get the best results from poultry that where meals and grains are fed they must be pure and wholesome. There is one source, and one only, from which a hen can manufacture eggs, and that is from the food she eats. If she is fed poor quality grain and adulterated meals, her digestive organs will be overtaxed, as she must get rid of all the rubbish before she can make use of the good, solid food from which she can produce eggs.

When it is remembered that there are on record authentic cases where hens have laid over ten times their own weight in eggs in twelve months, it can be readily understood why the digestive organs of a hen should not be given the unnecessary work of getting rid of a lot of foreign matter that is of no use either for egg production or for the nourishment of her body.

The bad quality of some of the pollard on the market is too well known to need any comment from me, and poultrymen would be well advised to use finely-ground barley, oats, wheat, and maize in place of it; these, in conjunction with bran, will make a very satisfactory mash.

I have examined many samples of mixed grain sold to suburban poultry-keepers at apparently low prices. In several lots, the mixing had been done to help to sell at least one inferior grain that was too poor in quality to be sold by itself.

I would strongly advise poultry-farmers to buy the different grains separately and do the mixing themselves. They would then be better able to determine the quality of the mixture.

Varied Foods Essential.

Next to purity comes variety. It must be realized that profitable egg production depends solely on the amount of food the birds can be induced to consume and digest.

The first call the hen makes on the food eaten is for the maintenance of her bodily warmth and for the repair of wastage of tissue, blood,

bone, and feather; and it is only after these needs are fully satisfied that any of her food is used for the manufacture of eggs. Therefore, if she does not eat a large quantity of food over and above that necessary for her bodily upkeep she cannot lay a profitable number of eggs. The only way to induce her to eat the required amount is to tempt her appetite with the greatest variety of food that can be obtained at a reasonable cost.

People frequently come to my office and tell me that their birds are seemingly in splendid condition; they have red combs and good plumage, yet they are laying badly. I make a few inquiries as to housing, &c.; and then ask about feed. The usual reply is, the birds get plenty to eat—bran and pollard in the morning, and wheat at night. When I ask what they are given the next day, or the next week, the callers look surprised and say, "Oh! the same; and as much as they can eat."

Now, I wonder how these people would get on if they had to sit down to corned beef and bread every day, week after week. They certainly would not be eating very much at the end of the month. Yet, to give human beings such unvaried diet is just on a par with giving fowls bran, pollard, and wheat, and nothing else, for long periods; they get tired of it, and eat just enough to allay the pangs of hunger and to keep up their bodily warmth, but they will not eat that extra bit that will enable them to lay a 2-oz. egg five or six days a week. Therefore, the slogan of the poultryman should be, "Variety and Palatibility," for if the feed is wanting in these two qualities profitable numbers of eggs cannot be obtained.

There is little trouble in most parts of Victoria in obtaining a sufficient variety of grains and grain offals; but I find a great difficulty in breaking down prejudices that exist against certain foods. One man will not feed Algerian oats, because they have too much husks; another objects to maize, because it is too heating; still another considers barley has too much starch, and that ground barley, ground oats, and ground maize are too fattening.

Yet we have for the last five years been demonstrating, by feeding experiments at the Poultry Section of the Werribee Research Farm, that all these foods can be used with advantage. The results obtained should be all the more convincing when we find that in the free-choice feeding system, where the birds have all the different varieties of foods to choose from, they eat large quantities of these despised grains and lay profitable numbers of eggs.

Cheapness a Necessary Factor.

The third essential point is cost of food. Very few foods, if any, are so essential that the poultry-keeper must feed them, regardless of cost. He has a large variety to choose from, and can frequently make a noticeable saving by varying the ration according to local prices and supply.

As an illustration: In 1920, a number of poultrymen told me they would have to go out of the business on account of the high price of

wheat, which was at that time 9s. per bushel. I pointed out that good Algerian oats could be bought at 2s. 8d. and 3s. per bushel, or 4s. 6d. for 60 lb. (the weight of a bushel of wheat); and that oats at 4s. 6d. for 60 lb. meant a very great saving as against wheat at 9s. per per 60 lb. Several of them expressed the opinion that birds would not lay so well on oats; and, to convince them, we carried out the following test at Werribee:—

Two pens of 36 white Leghorns were selected, as nearly equal as possible in age, breeding, and quality. They were housed under the same roof, and treated in the same way in every particular, except as to the grain fed. Both pens were fed wet mash every morning, consisting of equal parts, by measure, of bran, pollard, and chaffed green stuff, mixed with soup made from sheep's heads, livers, and beef scraps.

During the months of April, May, and June no bran was available, so ground wheat and ground barley, in equal quantities, were used in the morning mash in place of the bran. Chaffed green stuff was fed at mid-day. The grain fed to No. 1 pen was Algerian oats, straight from the harvester and not clipped or graded. No. 2 pen was fed wheat for the evening meal. The result of this test, which was for twelve months, was that the No. 1 pen, which was fed oats (at 3s. per bushel), laid an average of 170 eggs per bird and cost 6s. 11d. a bird to feed, and showed a profit of 16s. 8d. per bird over the cost of food. No. 2 pen, which was fed wheat (at 9s. per bushel), laid an average of 150½ eggs per bird and cost 9s. 4d. each to feed, and the profit over cost of food was 11s. 6d. per bird. The pen fed on oats, not only showed the highest profit, but also laid the greater number of eggs.

Now, if the pen fed on oats had laid 20 eggs a bird less—that is, the same number of eggs as the pen fed on wheat—they would still have shown a profit of over 3s. a bird more. This means £15 extra profit on every 100 birds, which might mean all the difference between success and failure. In the case of large farms, such as that of Messrs. Carter Brothers, of Werribee, it would mean at least £2,000 extra profit for the year.

Free-choice Feeding Better than any Balanced Ration.

We hear a good deal about balanced rations for poultry. I came to the conclusion long ago that it is hardly possible to feed an exactly-balanced ration, because almost every sample of any particular food will, on analysis, differ from every other sample; further, it is not practicable to have every lot analysed; but it is very necessary for the poultryman to know something of the elements contained in the food given and the egg produced.

Wheat, I suppose, is more largely used than any other food, and the chemist will tell you that grains of wheat and eggs are composed of practically the same elements—namely, water, protein, carbohydrates, fat, and mineral matter; but that does not mean that wheat alone is a suitable ration for egg production.

It is necessary to take the relative proportions of these elements in the two products. This has been clearly illustrated by Professor Deyden, of Oregon, United States of America, in commenting on wheat

as an exclusive food for egg production. He says: "Supposing a hen could be induced to eat 4 oz. of wheat every day, about 3 oz. would be required to supply her bodily needs, leaving 1 oz. for producing eggs: out of that, the hen would get enough protein to make an egg every three days, enough lime to make an egg every twelve days, but enough carbohydrates and fat to make three eggs a day."

The result would be she would lay an egg every three or four days, and two out of three would have a soft shell. However, she would not long continue to eat wheat every day without loss of appetite and health. What is true of wheat is true of most available poultry foods; none of them alone contains the proper proportions of the essential food elements for the production of eggs; but some, like milk and meat, are rich in protein, others, such as bran and pollard and grain, contain larger amounts of carbohydrates and fat; and still others, like shell and bone, are composed chiefly of lime and mineral matter. It is by combining these different foods in the right proportion that the hen is able to produce eggs economically.

Many poultry-farmers, guided by articles that have been written on feeding, endeavour to mix their poultry feeds according to a formula; and most writers give the proportions of protein and carbohydrates for a correct-balanced ration for egg production as 1 to 4 or 1 to 4½.

As a result of feeding experiments at the Werribee Research Farm, we find that birds, when a free choice of different varieties of foods is always available to them, lay eggs in large quantities at a low cost, particularly in the winter (when eggs are scarce and dear) on a ration as high as 1 to 6.77. So it is not wise for a poultry-keeper to adhere too closely to the proportions of a so-called balanced ration. Although, in theory, a bird may be said to require food elements in a certain proportion, it may be that she does not require these elements all the time in the same proportion. As a result of investigations made by a good many free-choice experiments at the Research Farm, I believe that both black Orpingtons and white Leghorns will, if given the opportunity, balance their own ration a great deal better than the average poultryman can do it.

Free-choice feeding, or the placing of the several varieties of foods in different hoppers and allowing the birds free access to them at all times, is being adopted by many poultry-farmers. I had a letter from Mr. Oxley, of Campbell's Creek, only recently, and he assures me that, after trying this system out in a large shed with 400 birds in it, he will never go back to any other system of feeding, as from last April the daily number of eggs from every ten of these birds has been seven.

An advantage in connexion with free-choice feeding is that the birds do not get over-fat. Under this system, as under every system, palatability is an important factor, for it is of the kind of food she likes best that a hen will eat most freely.

Green Fodder should be Always Available.

It is very necessary for birds to have supplies of succulent green stuff always before them, right up to roosting time. Indeed, I maintain that it is impossible either for the birds to produce eggs

economically, or to be kept in good health, unless they have ample and constant supplies of green stuff.

I do not look upon green stuff as a food, so much as an aid to digestion; and unless birds can be helped to digest their food rapidly they certainly cannot lay eggs in quantities.

Much has been written about the value of one green stuff over another for the production of eggs; but, from experience of feeding many different green crops, I would say that it does not seem to matter what kind it is, so long as it is young and succulent and the birds like it. So far as I have observed, the order of their preference is:—Young barley grass, rye grass, green oats, green peas, green barley, silver beet, lettuce, rape, green maize, lucerne. Mr. Macaulay, manager of the Burnley Egg-laying Competitions, speaks very highly of mustard, and certainly the birds seem to like it very much. In the northern parts of Victoria, where burseem can be grown, it is often fed to fowls, with very satisfactory results.

The full worth of succulent green food cannot be estimated by analysis, as its greatest value lies in its action on the other foods consumed by the birds. I am quite sure that it is only by the liberal use of it that the birds' digestive organs can be kept up to that state of efficiency that enables them to produce large numbers of eggs. For it does not matter from what fashionable strains your birds are descended, or on what mixtures of foods they are fed, their whole success as layers depends on their ability to digest the food given to them and to put it to the proper use.

Granulated wood charcoal should always be available, as well as good-quality shell and grit. Much of the shell that is sold for poultry is useless, being too soft from having been exposed to the sun. What is required is fresh, hard shell; and if it has a proportion of coarse gravelly sand in it, so much the better. When only the soft chalky shell is available, birds require, in addition, quartz grit, ironstone gravel, or broken china.

The best method of mixing wet mashes for poultry is to place the bran in the trough, saturate it with moisture, such as soup made from livers, sheeps' heads, rabbits, table scraps, or milk; dry it off with pollard or ground grains to a nice crumbly condition; then the chaffed green stuff may be mixed thoroughly through it. At the Research Farm, equal quantities, by measure, of bran, pollard, and chaffed green stuff are used. When using meat meal or dried milk, 10 lb. is added for every 100 lb. of other meals used, and the birds are given as much as they will eat in, say, twenty minutes. In winter or cold weather, pullets should have a small allowance of grain at mid-day, as well as a little green food; at night a full feed of mixed grain and, the last thing, a good supply of chaffed green food. I do not consider condiments or spices are necessary, and they are never used either at the Burnley Competition or at the Research Farm.

Finally, do not forget that the Department of Agriculture runs a poultry section at the Research Farm, expressly to gather information regarding the poultry industry, particularly on feeding; and such information as has been acquired will be freely communicated to any one seeking it.

BEES AND HONEY.

THE POSSIBILITIES OF THE INDUSTRY.

An Address by J. S. Eagland, Assistant Apiculturist, broadcast through 3LO.

The Varieties of Bees found in Australia.

In speaking on the beekeeping industry, it may be well first of all to give a few simple facts concerning bees, which, although already well known to those engaged in commercial apiculture, may be of interest to those who are not conversant with the subject.

There are in the world to-day some twenty known varieties of the honey bee, four of which have, at various times, been introduced into the Commonwealth.

The Black Bee was brought here from Great Britain about the year 1822, and has since spread practically all over Australia; it is the common bee most often found in the bush.

The Italian Bee was introduced some 50 years later, and is now generally recognized as the most suitable bee for commercial honey production, being easy to handle, very gentle, and an exceptionally good honey gatherer.

The Cyprian Bee is a comparatively recent introduction, but has not found favour with beekeepers owing to its being very bad tempered and difficult to handle. It is doubtful whether any pure Cyprians exist in Australia.

The Carniolan Bee, which comes from the European Alps, is also a recent introduction, and, while having most of the good points of the Italian, has one serious fault, that is, the swarming instinct, which is very strongly developed. This makes Carniolan bees somewhat difficult to control, but it is quite likely that they will be found suitable for our cold and mountainous districts, for which the Italian Bee is not altogether adapted.

The Colony.

Most people know by sight the honey bee, but probably many are not aware of the various duties carried out by the bees in the gathering of the season's honey.

I shall first explain the composition of a swarm of bees and what takes place when they are placed in a box, or lodge in a tree.

In the swarm there may be any number from 5,000 to 30,000 worker bees, according to the size of the swarm. There are usually, also, several hundred drones or male bees, and, of course, one queen bee, which is to be the mother of all the future bees of the swarm. The swarm when hived is called a colony, the hive being the box which contains the bees. Immediately the bees find they are in a suitable place, they begin to build comb, the cells of which serve the purpose of a storage place for honey, or alternatively cradles for the young bees. As soon as a small portion of comb has been built, the queen begins to lay eggs, depositing one egg in each cell; three days later this egg hatches, and the young larva is fed most abundantly by the nurse bees. After six days the

larva pupates, that is, passes into the chrysalis stage, and twelve days later emerges as a perfect honey bee.

For the first day or two the young bee does nothing but move about the hive, apparently developing its muscles and becoming familiar with the ways of the colony. After the second day it begins to clean and polish the cells from which itself or other bees have hatched, and make each of these cells ready for another egg to be placed in it. A few days later the work of nursing or feeding the young larva is taken up, to be followed in about a week's time by a transfer to the work of producing wax, and the building of comb; about a week later again, outside work is commenced, usually beginning with carrying water for the colony, or guarding the entrance of the hive against thieves, which may be bees from other hives, ants, or occasionally, human beings.

The next week or two, which is the last period of the bee's life, is spent on field work, gathering honey and pollen for future use by the colony.

During all this time the original bees of the swarm have been gradually dying off until by the time the young bees are old enough to take up field work, very few, if any, of the old remain; but once past this point, the colony gradually gains in numbers and stores of honey.

This indicates that a bee's life is very short, the normal life of each bee in the busy part of the year being from five to six weeks, each individual bee apparently working itself to death that the colony may survive.

Usually the only time that a bee lives longer than about six weeks is during the winter, when the hive is semi-dormant, and then the span of life may extend to three or four months or even more.

Now to say a few words regarding the honey that a colony may gather in the season.

As you probably know, bees gather honey from all kinds of flowers, and do not seem very particular as to what sort of flower it is, provided it contains honey. It should, however, be clearly understood that each variety of flora produces a different variety of honey, and, therefore, the honey collected may be anything in colour from water-white, through light amber, amber, dark amber, to almost black, according to the flora from which it was obtained, and the flavour is equally as variable as the colour.

The natural honey resources of Victoria are equal to, if not better, than those of any other country in the world, while our climatic conditions are so mild that wintering problems, such as confront beekeepers where their hives are under snow for several months in the year, are practically unknown here.

Bee-Keeping a Specialized Occupation.

I would point out, however, that beekeeping, as carried out for honey production in Victoria to-day, is undoubtedly a specialized occupation requiring as much experience as is necessary for any other occupation.

There is a prevalent idea among many people that it is only necessary to catch or buy a few swarms of bees, put them in hives, and sit down and wait for the honey to come in.

Well, experience teaches, and before very long that type of beekeeper learns that it is necessary to study the habits of the bees, the budding and flowering peculiarities of the flora of the district in which

he lives, and a host of small incidentals that make up the season's work on a bee farm. Once this knowledge has been acquired, and it will take a considerable time, beekeeping will be found to be a profitable, healthy, and most interesting occupation, giving quicker returns, and returns equally as good as those from most other agricultural occupations.

The Possibilities of the Industry.

The sub-title of my lecture to-night—possibilities—suggests that there is further room for expansion in the beekeeping industry. While at present beekeeping is among our minor rural pursuits, it is one in which there are big opportunities for increase in production, for there is not the slightest doubt that at the present time there are in Victoria large areas of good honey-producing country, of which, so far, no use has been made.

Now, before saying any more about that side of the question, I shall briefly review the present position of the industry.

There are in Victoria to-day 71,918 colonies of bees, owned by 3,483 beekeepers. Last year there was produced in the State 4,054,975 lb. of honey, and 47,117 lb. of beeswax. Of the 71,918 colonies, 63,515 are in frame hives, and yielded last year 3,951,439 lb. of honey, an average of 62¼ lb. per colony; 8,403 colonies are in box hives, that is, kerosene or other cases, without any frames in which the bees can build their comb. These colonies in box hives last year produced 103,536 lb. of honey, an average of 12¼ lb. per colony, exactly one-fifth of the quantity yielded by each colony in a frame hive.

It will be quite obvious from the average production just quoted that bees in frame hives are financially much more successful than bees kept in box hives, and the remedy for this loss of production is, of course, to discard the box hive and transfer the bees to frame hives.

I may mention here that pamphlets, giving directions for the making of frame hives and transferring the bees, are obtainable from the Department of Agriculture, free on application.

It is interesting to compare the position of five years ago with that obtaining to-day. In 1921 there were in the State 37,075 hives, which produced 1,724,942 lb. of honey. Our present position is, therefore, that we have approximately twice as many hives as five years ago, producing, approximately, two and one-half times the quantity of honey, the greater increase in production, when compared with the number of hives, being apparently due to improved methods in apiculture among the beekeepers.

Now, while the average production of each frame hive colony was 62¼ lb., there are in Victoria a large number of commercial beekeepers who have a yearly average of considerably over 100 lb. per colony, which further emphasizes the necessity for improved methods and wider knowledge by the average beekeeper.

Another way in which production per hive can be increased is by the use of pure Italian Bees exclusively. This was fully illustrated by an experiment conducted in Mr. F. R. Beuhne's apiary, during last year. Out of 80 colonies of Black Bees, the 23 best honey gatherers were selected and tested along with 71 colonies of Italians. The season's average production with the Black Bees was 94 lb. per colony, while the Italians averaged 139 lb., an increase over the Blacks of 45 lb. per

colony; thereby again demonstrating the marked superiority of the pure Italian Bees for honey production.

Having dealt with the present position regarding production per colony in Victoria, I shall now refer to the facilities of increased production by increase in the number of colonies in the State.

In Victoria licences are issued by the Forests Commission and by the Lands Department for what are known in the Crown lands under the control of these two bodies as bee sites and ranges. A site licence gives the holder the sole right to a particular site on which to keep his bees, and the range licence gives to him the sole right for his bees to all flora in the forest within a one-mile radius of his site. Thus, should another beekeeper desire to place his bees in the same forest, he will not be granted a site nearer than two miles from the first beekeeper.

At the present time there are approximately 225 of these licences held by beekeepers, covering an area of, roughly, 500 square miles of forest, while in Victoria, in areas more or less suited for beekeeping, there are approximately 6,800 square miles of permanent forest controlled by the Forests Commission, added to which there are still larger areas of Crown lands unallotted, much of which is in areas quite suitable for bee-culture.

Except for the small area already referred to, practically no use is being made of this huge area for bee-culture, and millions of pounds' worth of nectar produced anually by the flora of the forest goes to waste.

Study of our Forest Flora Necessary.

It may be pointed out here that approximately 90 per cent. of the honey produced in this State comes from the eucalypts and the various shrubs which accompany them under natural conditions. Of the remaining 10 per cent., the bulk is produced by the clovers, lucerne, and thistles. It will be seen, therefore, that we rightly regard the forest as our main asset for honey production.

Herein lies one of the greatest difficulties of the bee-farmer. There are in the forest a great variety of eucalypts and various shrubs, most of which are biennial or perennial in their flowering habits, rendering it well nigh impossible for one person to know the peculiarities of all of them even after years of experience.

The Department of Agriculture, through the exceptional knowledge of this subject possessed by our late Apiculturist, Mr. F. R. Beuhne, has done a little to assist the beekeeper in this difficulty by the issue, in book form, entitled *The Honey Flora of Victoria*, of a record of the flowering habits of our commoner shrubs and eucalypts, but *The Honey Flora of Victoria*, by its very usefulness, emphasizes the extreme necessity for further research into the flowering habits and peculiarities of our honey-producing flora.

A Defective Marketing System.

Bound up with the peculiarities of our flora are many other problems of the apiarist, too numerous to be dealt with now, but the greatest difficulty confronting us at the present time is the disposal, at a remunerative figure, of our honey crop. There are various reasons which combine to make our markets unsatisfactory.

First, the consumption of honey in Australia during the last five years has been approximately 1 lb. per head per annum. Most honey-

producing countries, notably America, consume from 2½ to 3 lb. per head in the year; therefore, there must be something very much wrong in our marketing system if the public cannot be persuaded to eat more than 1 lb. of honey each in twelve months.

One reason for this position is that, even when a consumer gets a variety of honey that is suitable, there is no trade name or description by which a further supply of the same variety can be ordered.

I will refer to jam to illustrate this point. If a consumer desires to repeat an order for jam, it is only necessary to look at the wrapper to see whether the previous order was melon, plum, quince, or whatever the trade name happens to be.

With honey there is nothing on the package to indicate whether it is honey from box, stringybark, clover, lucerne, or one of the host of other honeys common to the State. This places honey at a big disadvantage when competing with other foods, and the consumer not being able to get the variety he wants, through not knowing what to ask for, usually goes without any at all.

While trade names for our honeys would improve the position considerably, they would not be completely satisfactory, because, as has been explained earlier, most of our flora being biennial or perennial in flowering, it would be impossible to maintain continuity of supply of each variety from year to year.

The only satisfactory solution of this problem then would appear to be a standardized blending, in each class, of the different honeys in that class, so that if one or more varieties of honey be unprocurable, the blend could still be maintained by increasing the proportion of other honeys of similar characteristics, thus maintaining for the public continuity and uniformity of supply.

Of course, another alternative to increased local consumption is export trade, which, undoubtedly, is essential to the further development of the industry, but what has already been said regarding standardizing our honeys for local consumption applies even more forcibly to the export trade.

The position relative to export is, apparently, that the markets are available, but owing to lack of organization among the producers, a standard article cannot be made available; consequently, our export trade is, at the present time, practically nil.

That the marketing position in Victoria is even worse than that of other States will be realized when it is pointed out that, during the last five years, Victoria has produced 37 per cent. of the total honey of the Commonwealth, the nearest approach of this being New South Wales with 26 per cent.; Victoria and New South Wales combined producing 63 per cent. of Australia's total production.

Conclusion.

To briefly sum up the position in Victoria. Our climate conditions are eminently suited for bee-culture. This is evident by our high average yield per colony, and our large production compared with other States.

There are in Victoria enormous areas of suitable country not yet being utilized for honey production. And, provided our local and export marketing arrangements are placed on an organized and uniform basis, a considerable increase in the honey production of this State will surely follow.

PLANTING THE POTATO CROP.

An Address by J. T. Ramsay, Potato Expert, broadcast through 3LO.

Preparing the Soil.

The planting of the potato crop in Victoria extends over a considerable portion of the year. Commencing as early as June, in districts favoured with a mild climate, a succession of plantings continues without a break from June to December, and in the case of very late districts even into January.

The major portion of the acreage in Victoria devoted to potato culture is usually planted during the period extending from the middle of October to the end of November. Since that is so, this opportunity is taken for a talk on the operation of planting potatoes.

There is still a good deal of looseness or carelessness extant amongst farmers who devote land to the production of the potato tuber. This is rather surprising in view of the fact that not only is the potato crop one of the biggest revenue-producing crops in this State—but it is one of the most expensive to produce. Few others entail the capital expenditure per acre which has to be invested in a potato crop, because its cultivation involves the practice of intense culture. As a rule, the class of land in which it is produced, is high priced, and the sequence of cultural operations necessary for its maximum and complete development are such that they cannot be given without the expenditure of much time, labour and money. Striking an average of the soils in Victoria in which the bulk of the State's potato production takes place, I estimate that about £14 or £15 per acre is a fair assessment of the cultivation cost up to the point of digging. After that, costs for digging, bags, and marketing are, of course, contingent and dependent on the weight of crop produced.

Since, then, in growing potatoes, one is dealing with a business involving an outlay of a large amount of capital, it is most advisable and even necessary from the economical stand-point that the operations incidental to the planting of this crop be carried out in such manner as will give it every opportunity of a successful start.

I have previously* stressed the necessity for thorough preparation. Cultivation is required in order to produce a good seed bed in which to plant the sets, and in dealing with the work of planting I will assume that the land to be planted has been treated in the way recommended. The actual planting is for the most part done by hand, though a fair percentage of the Victorian crop is seeded with mechanical planters. Both of these methods are efficient. Where hand planting is resorted to it is advisable, first to run the harrows over the fallow to be sown so as to produce an even surface in order that the plow may be permitted to work at a regular depth. It is not advisable to harrow more than a day or so ahead of planting, as, in the event of rain setting in, the soil, worked down finely by the harrows, is liable to become baked on the surface. The sets should be placed on the plowed land side of the furrow, as there they are not only in loose soil, but also out of the way of the horses' feet, when covering is being done, and are, therefore, less liable to injury from this source.

* See this *Journal* for October, 1926.

The single, double, or treble furrow plow may be used; the latter, of course, is the one most commonly employed. An excellent combination, however, is a single and a double furrow plow working together; for some reasons this outfit is really better than the treble furrow plow. One of the main reasons why the single and double plows have the advantage is that the furrow in which the potato sets are placed need not be opened until planting is actually ready to be done. This is an important point when weather conditions are dry and warm. If the planting furrow is left open for even the space of time of the lunch hour, on a warm day, the crop resulting from it is invariably lighter than in the adjoining rows.

Manuring.

In practically all cases some manure should be given to fortify the natural fertility of the soil. It is, of course, impossible to give specific advice as to quantities and kinds of manure to suit all classes of soils. I can speak only in a general way now. The districts in which the planting will be carried out extensively during the next six or eight weeks* are the Central District and Gippsland. The Central District is comprised mostly of red volcanic loam which responds to light applications of superphosphate at the rate of 2½-3 cwt. per acre. The majority of the Gippsland soils, however, require much heavier dressings, and a mixture of superphosphate and ammonium sulphate is recommended for these at the rate of 6 cwt. superphosphate and 1 cwt. ammonium sulphate per acre. Where manures are applied they should in all cases be placed in the furrow with the seed. This is another important point. It has been proved by numerous tests that by having the manure in close proximity to the seed sets the resulting crop is invariably heavier than when the fertilizer is broadcast prior to planting. Research work has shown that the potato plant takes up plant food much more rapidly in the early stages of its growth than it does later. This fact emphasizes the advisability of having the manure close at hand to supply the needs of the crop immediately its root system commences to develop. If the fertilizer is broadcast and harrowed or plowed in, a great percentage of it is distributed at such a distance from the sets that considerable root growth must be made before they make contact with the fertilizer. Consequently, rapid growth of the young plants is not possible, and the crop suffers a handicap which it can never subsequently overtake. There is on account of this fact a corresponding lessening of the rate of production per acre.

Depth at which to Plant.

Another factor of importance to be considered is the depth at which the sets are placed in the soil. The potato is a sun plant, and the shallower the depth at which it can be grown the better. It revels in a combination of sunlight and moisture. The habitat of the original wild potatoes from which all improved and commercially grown varieties have evolved is in the tropical belt of South America. Under tropical conditions there is, of course, an abundance of summer rain. The fact that the potato is a moisture-loving plant, and remembering the actual natural environment to which it is indigenous, makes it easy to comprehend that the governing factor of the depth at which it should be planted

* This address was delivered on 15th October, 1926.

is the shallowest depth at which it can be assured of the requisite moisture for its needs. Now, sub-tropical and temperate zones, in which the bulk of the world's potato crops are produced, are not subject to the superabundance of rainfall of the tropics. Therefore, in these zones deeper planting to ensure a supply of moisture for the crop is necessary. Indeed, in these zones, especially in the more southerly parts of Australia with its heavy winter and light summer rainfall, reliance has to be placed on cultivation to conserve moisture precipitated in winter in order to augment the meagre rainfall during the season of the year in which the crop is grown. It will be understood, of course, that in a talk such as this where listeners are spread over such a wide area with its tremendous divergencies of climate, I can speak only generally on this subject. Intelligent modification can, however, be made to suit particular local conditions. For the average local conditions prevailing in Victoria the best depth of planting is made at from 4½-5 inches.

About that depth under normal weather conditions the maximum yields per acre are obtained. I would like here to draw the attention of growers who are using the machine planters that there is always a danger of these machines planting the sets at too shallow a depth. The ridging done by the covering discs of these machines is apt to deceive the grower. If any difficulty is experienced in getting down to 4½ or 5 inches with the machines, a good plan is to immediately precede the machine planter with a spring tooth cultivator set to full depth. This operation will, by its loosening effect on the soil, permit the mechanical planter to bury the sets at the desired depth of 4½-5 inches.

The Cutting of Potatoes for Seed.

Now regarding the cutting of seed potatoes and the rate of seed to be planted per acre. The cutting of potatoes to be used for seed is essentially an economic question. In cases where only large tubers are available for planting, it becomes necessary to subdivide these in order that they may provide a greater number of sets, and so keep down the cost of seeding per acre. In subdividing or cutting these, however, many growers go to extremes and slice up the tubers into pieces which are too small. Where this is done, the crop is handicapped at the outset. The question may be asked—What is the best-sized set? Before a direct answer can be given to this, several factors have to be considered. The first of these is the vigour of the seed parcel. Seed of weak constitution will not stand as much cutting as seed which has been selected out of a healthy and prolific crop.

Undoubtedly one of the main reasons for varieties of potatoes so quickly degenerating to a level at which their cultivation ceases to be profitable, is the fact that practically no selection of seed is made, and the seed used is too severely mutilated by the cutting knife. The second factor is the moisture content of the soil in which the seed has to be planted. Extremes of moisture and dryness are certain causes of "misses" when small-cut sets are used. Therefore, unless the soil is in a nice condition of moisture, either whole or fair-sized cuts should be planted.

A third consideration is the fertility standard of the soil. If the fertility and physical condition be good, the use of small-sized sets is permissible. The following comments and recommendations are based on the assumption that normally good potato land in a good state of

tilth is to be planted, and that a parcel of potatoes made up of seed and ware sizes is available for the planting. When commencing to cut the seed it should be borne in mind that within reasonable limits the weight of the crop is proportionate to the weight of the seed used per acre.

The fundamental reason for this is that the shoot or shoots produced from the seed set are, in the first stages of growth, entirely dependent on the nourishment they derive from the seed set. That being so, it is obvious that the larger sets can give a better start to the crop than can the small sets, simply because they contain a greater amount of the essential nourishment for the first growths. Under exceptionally favorable soil conditions good crops have been grown from sprouts which have been removed from the tubers, but this degree of culture is not feasible in ordinary farm practice, and it is questionable if the prolificacy of a variety so treated would not be rapidly impaired by this method.

In no circumstance should tubers of less than 1¼ oz. be used as seed for a field crop; in fact, seed of less than 1½ oz. weight should not be used if the soil and the seed are not in the best of condition. In cutting large tubers care should be taken to see—first, that at least one good eye is left on each section; second, that the sections cut be as uniform in weight as possible and not less than 1½ oz. in weight (so much the better if they are from 2½ to 3 oz.); third, that portions showing weak buds are discarded. A fairly common practice of some growers is to rub off all sprouts which may be growing from the tubers at the time of planting. This is a certain error. By doing so, the seed tubers are set back for some weeks in their growth, and are devitalized to the extent of the nourishment which they expended in producing the destroyed shoots. It may be contended that the shoots are sometimes too long to permit the tubers being handled without breaking them. If the tubers have long shoots growing from them, they are merely giving ocular demonstration that the grower's system of storage is very much at fault, and this should urge him to the adoption of the system of storing his seed in proper seed potato boxes. Desprouting means devitalizing—that is beyond argument. It is advisable that seed when cut be placed in the ground as soon as possible. It is courting failure to cut and store it for some days before planting. The result of hundreds of tests prove that seed planted on the same day as that on which it is cut gives the heaviest yield. The dusting of lime, ashes, or sulphur on the seed to dry the wound caused by cutting is not necessary, as the ruptured starch cells quickly dry on exposure to air. Sulphuring may at this stage have some advantage, not as a drier but on account of its being fungicidal in its action. It cannot, however, in this capacity be as effective as spraying the growing crop.

Provided that the tubers used for seeding are normally healthy and are cut into pieces of equal weight, no section of the potato has superior vigour to another, i.e., stem ends and terminals are of equal value, weight for weight. The number of eyes on each set is of minor importance—it is the size of the set which counts.

Spacing of Rows.

For general practice, the spacing recommended by this Department is 27 inches between the rows and about 14-16 inches between the sets in the rows. If planting is done at these distances, and 2 oz. is the average weight of the sets, approximately 17 cwt. of seed per acre

will be required for planting. This is not a bit too much. The experience of specializing potato-growers goes to prove that it is sound business policy to use fairly heavy ratings of seed per acre and to manure liberally.

Eugene Grubb, who acted as Special Commissioner to Europe in the Potato Investigations for the United States of America Government, in summarizing the data obtained in the foremost potato districts of the world states—"The practice of successful growers indicates the best policy to be—High fertility of soil, close planting, heavy rate of seeding per acre." These elements of success in potato growing are within the control of the Victorian farmer, and until growers adopt improved methods of dealing with the crop, the average production per acre for the State (under 3 tons), will continue to be an unpleasant reflection.

It is of greater moment that the acres at present cultivated should be made to produce more than it is that more acres should be brought under cultivation. The former would mean a really progressive increase in the State's production, while the latter (with present-day farming standards) would only increase the magnitude of current mediocrity. With regard to the spacing between the sets, in the case of early varieties such as Carmen I. and Manistee, these may be placed 14 inches apart in the rows. In the case of late varieties, like Late Carmen, Up to Date, and Snowflake, spacing for these may be widened out to 16 inches. The reasons for these differences in spacing between early maturing and late maturing varieties is that the early varieties as a rule produce smaller topped plants, and do not require so much room for development as do the large-topped late varieties.

During the past twelve years I have judged many field crops throughout the State, and I have found almost invariably that the winners on points of quality and weight of tubers have been growers who practised close planting. Coincidentally with my writing reports on crop competitions conducted by agricultural societies this year, in which I stressed the advisability of close planting, there came to hand from the Ministry of Agriculture for North Ireland the results of trials conducted on planting of potato sets at different distances apart. The results obtained from these trials so emphatically support the soundness of the practice of close planting which has been very strongly recommended by the Department, that they are worth quoting here. The test was carried out at Stormont in 1924, in which on three plots the sets were planted at distances apart of 10-15 and 20 inches in drills 27 inches wide, and the results were as follows:—

	tons	cwt.	
10 inches between sets	16	17	per acre.
15 „ „ „	13	4	„ „
20 „ „ „	11	19	„ „

A feature decidedly in favour of thick planting was that the tubers produced were invariably more uniform in size and shape and more attractive for marketing purposes than where thinner planting was adopted.

While it is not advocated that, in general potato-growing in Victoria, potatoes should be planted so close as to allow only 10 inches between sets in the rows, this spacing could be approximated with advantage by growers for the earliest market (about October-November). These very early crops are generally grown in soils of a light character—sandy to

loamy soils—which are fortified, either naturally or artificially, to a high standard of fertility. The higher the fertility of the soil in which the potato crop is grown, the closer the planting should be. For late crops grown in heavier soils, planting should be done at wider spacings on account of late varieties growing large tops, and consequently requiring more room for development. The practice common amongst growers of late varieties, however, of spacing out their sets to 18, 20, and even 24 inches between them in the row is merely waste of ground. There is no justification for wider spacing than 15 or 16 inches between the sets of late varieties. A distance of 27 inches between the rows, which equals 29 rows per chain, has been proved to give ample room for horse cultivation in the heaviest ground, and this could with advantage be reduced to 26 or even 25 inches on fairly level country of light texture.

Planting in Irrigation Areas.

Plow planting is best here. If dry, it is advisable to irrigate first, then harrow as soon as possible, then cultivate and harrow immediately afterwards to conserve moisture. Plow, plant, and harrow each half day's planting before leaving. Never leave planted furrows open at lunch hour or overnight. This is possible with single or double plows. Do not leave furrow to be planted open, but plow a seed-covering furrow and leave planting furrow to be opened fresh after lunch or at the morning renewal of planting operations.

Weeds Must be Kept Down.

As it will be some weeks before I am broadcasting again on the subject of potato cultivation, I take this opportunity of advising growers to keep the harrows moving frequently over planted areas, so that a nice loose condition of the surface soil may be maintained. Frequent harrowing will also kill young weeds which are sure to grow, and will prevent them making headway to the detriment of the crop. It will also conserve moisture in the soil by practically arresting the capillary movement of the moisture at the depth at which the mulch is maintained by harrowing, thus preventing the water content of the soil from reaching the surface to be lost by evaporation.

The Importance of Conserving Moisture.

Another beneficial effect produced by this cheap harrow cultivation is that the surface soil is kept in such a loose condition that when further rains fall the ground is in an excellent condition to receive them, and allow them to percolate through the soil. Land which is hard, baked, or set on the surface absorbs rain water only very slowly, the bulk of it, especially in case of heavy rain, merely running over the surface to the lower levels, and the greatest proportion of it is lost as far as the crop is concerned. Moisture in soils moves upward to the surface from lower levels by what is known as capillary movement, and if the atmospheric conditions are drier than the soil, the moisture is evaporated slowly or quickly according to the degree of variation of moisture content of soil and air. Under very favorable conditions for evaporation, that is dry hot weather in combination with wind, particularly a north wind, evaporation or loss of moisture from soil can take place at a tremendously rapid rate. It has been estimated that under favorable

conditions this loss by evaporation can reach the rate of about 100 tons of water per acre per fortnight. Now since 100 tons of water represents approximately a 10-inch rainfall, none of which has been allowed to run off the land, but all of which has been absorbed, the necessity of countering this possible loss by cultivation can be appreciated. Capillary movement of moisture takes place most easily and most rapidly when soil is compact from the surface downward. This compactness enables the film of moisture surrounding each soil particle to have continuous passage to the surface. A 10-in. rainfall is more than usually falls during the whole of the growing period of the potato crop, taking an average of all of the potato-growing districts. This being so, it can be readily understood why efforts should be made in countries with low summer rainfall, that is, low rainfall during growing period, to conserve soil moisture as far as possible. It may appear that the conservation of moisture has been stressed more than the actual operations of planting, but this moisture conservation is of such paramount importance under Southern Australian conditions that it overshadows other points pertinent to potato-planting. Indeed, so much is this the case, that if soil conditions by cultivation are produced, such as will ensure the greatest degree of moisture retention, together, of course, with good drainage, then there is not much margin left for error in the operations incidental to planting.

DRIED VINE FRUITS.

Report of the Imperial Economic Committee.

The third report of the Imperial Economic Committee on Marketing and Preparing for Market of Foodstuffs Produced in the Overseas Parts of the Empire has just been issued. This report deals exclusively with fruit, and the following is a summary of the section dealing with dried vine fruits, viz., currants, raisins, and sultanas.

The average yield of currants in the dried form throughout the world is between 20 cwt. and 30 cwt. per acre, while the average yield of the sultana in the dried form is between 15 cwt. and 20 cwt. per acre. The average yield of raisins per acre is about 20 cwt. to 25 cwt., except in Spain, where it is said to have reached only 15 cwt. per acre. The currant is a small black seedless grape, while the sultana is a white seedless grape. The raisin is also a white grape, but it contains seeds.

Present Sources of United Kingdom Supplies.

Up to 1920 the export of currants in any considerable quantity was limited to Greece, of raisins to Spain, and of sultanas to Turkey. Since that date, however, while Greece still remains much the most important currant-producing country in the world, Spain has lost her predominant position, and the United States of America, Australia, and South Africa have risen rapidly from insignificance to importance as producers and exporters of raisins and sultanas.

It is interesting to remember—in connexion with variations in prices which we shall notice later—that the sultana as grown in

Turkey, Australia, and South Africa is the "true" sultana, while the Californian product is usually one of several varieties of white grape of the sultana type. It should also be mentioned that the fruit grown in Spain is the raisin, and that the decline in Spanish exports has been accompanied by an increase in exports from sultana-producing countries.

In 1924 (figures for 1925 are not yet available) there were in effect only two sources of supply from which the United Kingdom obtained its currants, Greece and Australia. These countries together supplied 99.9 per cent. of the total importation. Greece was much the more important of the two, sending no less than 86 per cent.

CURRANTS.

Countries whence consigned.	Cwt.	Per cent.
Greece	1,158,611 ..	86.3
Australia	183,134 ..	13.6
Total (from all sources)	1,342,293 ..	100.0
Re-exports	65,597 ..	—
Net imports	1,276,696 ..	—

The United Kingdom Trade Statistics do not differentiate between raisins and sultanas—both are included under "raisins." Although in 1924 the United Kingdom obtained most of its supplies of raisins and sultanas from foreign sources, the largest individual supplier was Australia, which sent nearly one-third of the total importation. South Africa sent a small quantity. The main foreign suppliers were Turkey (Smyrna), the United States of America (California), Spain, and Greece. Full particulars of the imports of raisins and sultanas for 1925 are not yet available, but the following statistics giving the importation from certain countries are of interest:—

Countries whence consigned.	Cwt.	Per cent.
Australia	354,647 ..	31.3
South Africa	36,705 ..	3.2
Spain	178,597 ..	15.8
Greece (excluding Crete)	31,860 ..	2.8
Turkey	112,497 ..	9.9
United States	368,864 ..	32.5
Total (all sources) ..	1,133,462 ..	100.0
Re-exports	60,591 ..	—
Net imports	1,072,871 ..	—

It will be noticed that in 1925 the United States of America was the principal source of supply of raisins to the United Kingdom.

The tables contained in the report show the great development of Australia as a producing country. It supplied only .7 per cent. of the total importations for the quinquennial period ending 1913, and nearly one-third of the total in 1924 and 1925. South Africa, too, has largely increased its supplies to the United Kingdom, although it still occupies a somewhat unimportant position. The increased supplies from these two Dominions have done much to modify the pre-war position, when the United Kingdom relied almost entirely upon foreign countries for its supplies. In 1924, 62.9 per cent. came from foreign countries, as against 98.2 per cent. in the quinquennium ending 1913.

Consumption in United Kingdom.

The consumption of currants per head per annum of the population of the United Kingdom for the quinquennium ending 1904 was 2.7 lb., and for the quinquennium ending 1913, 3.0 lb. The consumption per head for the year 1923 was 3.7 lb.; for 1924, 3.2 lb.; and for 1925, 3.1 lb. The consumption of raisins and sultanas per head per annum of the population (figures showing consumption per head of all three classes of fruits —currants, raisins, and sultanas—in parenthesis) for the quinquennium ending 1904 was 1.7 lb. (4.4 lb.), and for the quinquennium ending 1913, 1.7 lb. (4.7 lb.). The consumption per head for the year 1923 was 2.5 lb. (6.2 lb.); for 1924, 2.5 lb. (5.7 lb.); and for 1925 2.7 lb. (5.8 lb.).

Countries of Production.

The Committee, after describing the production of currants in Australia, states that the production of that fruit in South Africa, although increasing, is not yet sufficient to supply the local demand, and there is, therefore, no export to the United Kingdom.

Greece is to-day, as she has always been, much the most important currant producer and exporter in the world. In the coastal strip, some 250 miles in length, between Corinth and Calamata, 150,000 acres are under cultivation. The production, which in a good season exceeds 3,000,000 cwt., is greater than the total world consumption. As a consequence, the disposal of the whole of this presents a serious annual problem. So much so, that the Committee do not anticipate any important increase in acreage under cultivation, nor, therefore, in output during the next several years.

The extension of currant cultivation within the Empire will be conditioned by the availability of markets to absorb an increased output. In considering this problem, Empire producers must recognize that they will have to compete with enormous supplies from Greece. The fact that Empire supplies arrive in the United Kingdom when Greek supplies are already some months old gives the Empire producer an important advantage. Apart from that consideration, however, the Committee is convinced that the Empire producer cannot hope to market currants at satisfactory prices in the United Kingdom unless the quality is definitely superior to the bulk of the foreign supply.

In connexion with raisins and sultanas, the report, after describing Australian production, states that one part of South Africa is well suited to the production of these dried fruits—the Western Province of Cape Colony. Throughout the rest of the territory of the Union summer rains make profitable production impossible. In this favoured area, however, production has rapidly increased, and now amounts to over 100,000 cwt. per annum, of which total nearly half is exported to the United Kingdom. The Committee is assured that a steady and fairly rapid increase of output may be expected during the next few years.

Excluding unimportant areas in Texas and Arizona, the production of dried fruits in the United States of America is confined to the San Joaquin Valley in California, and to a small area north of Sacramento. The output, mainly of fruits of the sultana type, has increased at a remarkable rate, and according to one authority is now of the

order of 3,000,000 cwt. per annum. This is so far in excess of American requirements that the disposal of the surplus presents a serious and permanent problem. Large sums are spent on advertising, both in the United States of America and the United Kingdom, but it seems doubtful if supply and demand will be in reasonable equilibrium for some time. In view of this, the Committee does not anticipate any important increase in the area under cultivation.

In Turkey the most important dried fruit is the sultana, produced in the area round Smyrna, which is the centre for grading, packing, and export of all supplies grown in the neighbourhood. So far as the Committee can ascertain, no increase is probable in the area under vines, but some increase in the yield of the existing vineyards may be expected.

In Spain, dried fruits, mainly raisins, are produced along the south-east coastal areas of Valentia and Alicante. Output has been declining for many years, partly on account of the change in public taste, which prefers sultanas to raisins, and partly owing to the spread of disease due to the Phylloxera in the vineyards. This decline has, however, been checked during the last two or three years, more by reason of the substitution of vines on American resistant stock for the old and diseased vines, than by any increase in the area under cultivation. The Committee consider that the area under raisin vines in Spain may be expected to remain fairly stationary during the next few years.

Greece produces annually about 80,000 cwt. of sultanas in an area near Corinth, but this output appears to be stationary.

The settlement in Crete of a large number of Greek refugees from Turkey has been followed by a very rapid development of sultana production. Unimportant before 1922, the annual output has already reached 70,000 cwt., and the Committee have been informed that within the next few years it may increase to 200,000 cwt.

With sultanas and raisins, as with currants, the Empire producer is in the position of being able to place his fruit on the United Kingdom market when supplies from other sources are some months old. Further, it is reasonable to expect that the Continent of Europe will absorb more of the foreign supply in the future. But, far more important than these considerations, is the question of quality. The surplus output from California threatens to keep prices depressed for some time to come. Therefore, those producers, whether within or without the Empire, who produce fruit of substantially the same quality as California cannot reasonably hope for satisfactory returns during the next few years. The Committee, however, has been informed by several witnesses that the bulk of the Californian output, although of very uniform quality, well graded, and extensively advertised, is definitely inferior to the bulk of Empire supplies. Therefore, provided that the Empire producer at least maintains, or, preferably, raises his standards of quality, he can, to some extent, ward off the most serious effects of competition from the enormous Californian surplus.

Preferential Tariff in the United Kingdom.

Currants have for several centuries been classed as a dutiable article on importation into the United Kingdom. The rates of duty on currants before 1890 were on the average about the same as those

levied upon raisins. In that year, as a result of a commercial treaty between His Majesty's Government and the Greek Government, the duty on currants was reduced from 7s. per cwt. to 2s. per cwt. In effect, this reduction gave Greece an important preference in the United Kingdom market over other countries supplying other dried vine fruits. In 1919 a preferential rebate of one-sixth of the duty was granted to Empire currants. In 1925 this preference was increased to 2s. per cwt. by the admission of Empire currants duty free.

Raisins also have been dutiable on importation into the United Kingdom for a very long period. In 1823 a definite Colonial preference on raisins appeared in the Customs Schedule. The lowest rate applied to foreign raisins was £1 per cwt., whilst fruit from the Cape of Good Hope or from the East India Company's territories was charged 10s. per cwt. From 1823 to 1853 a preference of about 50 per cent. on the lowest duty charged on foreign raisins was allowed on raisins produced in British possessions. Preference on Empire dried fruits disappears from the Customs Schedule from 1853 until 1st September, 1919, when a rebate of one-sixth of the duty of 10s. 6d. per cwt. was introduced. In 1924 the duty on raisins was decreased to 7s. per cwt., thus automatically decreasing the value of the preference. In 1925 the preference was increased to 7s. per cwt. by the removal of the duty on Empire-grown raisins.

Labour Conditions.

The significance of differences in labour conditions in dried fruit producing countries lies in the fact that, although the operations of grading and packing can to some extent be carried out by machinery, the processes of picking and drying must, in the nature of things, remain tasks which can only be performed by hand labour, states the Committee. Low wages have, therefore, a special influence on prices. The standards of living amongst the workers in the dried fruit industry vary so widely throughout the different countries that a price which would be satisfactory to one set of producers would be quite inadequate to another set. The Committee recognize, of course, that a wage which will provide a worker and his family in one country with food, clothing, housing, and other needs, may be quite inadequate under the conditions of another country. For present purposes the wage rates where available are compared with reference to the cost of production, and are not, says the report, intended in any way to contrast standards of social well-being.

Hours, wages, and conditions are regulated in Australia by the Federal Arbitration Court awards. Wages for adults of either sex are about 1s. 9d. an hour, or £4, for a week of 48 hours. Overtime varies from time and a quarter to time and a half, with double time on Sundays and holidays.

In South Africa wages vary according to districts, and in addition housing, garden, irrigation, and farm produce may be supplied. The hours worked are usually from sunrise to sunset. Generally speaking, the use of coloured labour involves the employment of white foremen, and although the wages paid to the coloured worker are low when judged by Australian standards, they are higher than those in some of the foreign dried fruit producing countries. In some of the packing

houses in South Africa native labour is being dispensed with and only white labour employed.

There is no regulation in Greece of hours of labour, which during the packing season extend from daylight until dark. It is difficult to obtain figures of rates of wages, and, owing to fluctuations in the drachma, to compare such figures as are available with rates for other countries. So far as the Committee were able to ascertain, agricultural wages in 1924 were—ploughmen, 2s. to 2s. 6d. a day; boys and women, 1s. to 1s. 6d. a day. During the harvesting period wages increase, both in money and in kind, up to 3s. or 4s. a day for men and 2s. or 2s. 6d. for women. Men in packing houses in the ports can earn 10s. a day on piece-work, and women 2s. to 3s.

Many of the vineyards in the United States of America are small enough to enable the owner and his family to do all the necessary work, and, therefore, wages in the ordinary sense are not paid. Additional labour can only be hired at very high rates. The Committee was informed that wages may exceed £1 a day even for boys of fifteen, and are higher than those paid in Australia. There is no State regulation of wages and hours of labour in California as there is in Australia, and it is understood that the working day in California is longer than that worked in the Australian dried fruit industry.

In Turkey during the harvesting and drying season (August to October) the working day may be of any length, often from daylight to dark, and wage rates vary with different conditions. It is understood that the average wage in Turkey during the greater part of the year is from 5s. to 7s. 6d. a week for men and from 3s. to 5s. a week for women. For the packing and preparation of the fruit for shipment, it is customary for the shippers and packing houses to give out the work on contract to gangs of workmen, who are generally employed from year to year. The work is hard, and during September and October is carried on continuously night and day, generally in shifts. The packing season lasts nearly three to four months in all. During this period experienced workmen earn much larger remuneration than the normal agricultural wage.

In Spain, during the harvesting and drying season, work lasts from sunrise to sunset. So far as the Committee were able to ascertain, agricultural wages are approximately from 2s. to 3s. a day for men, and from 1s. 2d. to 1s. 6d. a day for boys and women.

Grading and Packing.

(*a*) *Currants.*

The report points out that all grading and packing of dried fruit in Australia is carried out by machinery in central packing sheds, though, in the opinion of the Committee, elaborate refinement of grading cannot be achieved by machinery to anything like the same extent as is possible when grading is done by hand. On the other hand, grading by machinery is more hygienic than grading by hand. Before the coming into force of the new regulations in Australia whereby all packing sheds must be licensed and packing carried out under Government supervision, many complaints were made with regard to the quality and standard of grading and packing of Australian currants. Consignments to the United Kingdom on examination have

been found to contain currants which should have been sorted into not less than five different sizes and qualities, and sellers in the United Kingdom were obliged to open every box. The Committee observes that though great improvement has recently been made, and the standards of grading and packing improved, complaints are still received regarding the quality of the fruit. So far as the 1925 currant crop was concerned, the Committee point out that this was chiefly due to heavy thunder and hail storms during the picking season. In the Committee's opinion, a further disability has been experienced in consequence of an endeavour by the Australian currant grower to reduce his costs of production. With this end, the report states, the grower has tended to economise the labour employed in harvesting, and this has precluded that uniformity of quality and appearance which is essential for currants to obtain the highest prices in the United Kingdom market. However, recent reports from Australia show that careful attention is being directed to these matters, but the Committee points out that the necessity for consistent effort along these lines on the part of the Australian grower and packer will be realized when the heavy competition which he must face from Greece is considered.

In distinction to methods employed elsewhere, Greek currants are graded almost entirely by hand, packing being done either by special machinery or by the bare feet of the workers. Generally speaking, while the grading of Greek dried fruit is excellent, its packing has not been found to be of a very high standard. No Government control is established to ensure that any standards of quality, packing, and grading are maintained, but the reputation which the best quality Greek currant has secured in the United Kingdom market is such that the individual shippers endeavour to maintain the standard.

In comparing Greek currants with Australian currants, the report states, it must be admitted that while the best Vostizza currant is usually superior in quality to the best Australian currant, the average Australian currant is in normal years better than the average Greek currant.

(*b*) *Sultanas and Raisins.*

The Committee observes that the grading, quality, and condition of Australian sultanas at the present time are reported by the trade to be excellent, with the result that they command comparatively high prices in the United Kingdom market. In the past, Australian growers of sultanas have not laid any great stress upon appearance, but have concentrated upon the intrinsic quality of the fruit. It is the case, however, says the report, that appearance alone is of very great importance on the London market. In fact, where flavour, size, and intrinsic quality are equal, colour alone can account for a difference of 40s. per cwt. in the price. In view, therefore, of the emphasis laid by the English market upon appearance, steps are now being taken to produce a light-coloured fruit of even grade calculated to meet the United Kingdom requirements. This has done much to raise the reputation of the Australian sultana in the United Kingdom. One notable fact with regard to Australian dried fruit is that sulphuring is not used. Sulphuring produces a bright, clear colour in the fruit, but undoubtedly spoils the flavour and quality of the fruit itself. The Australian consumer had always preferred the fruit in

the natural form, and this method of supplying the fruit has been extended to consignments shipped overseas.

In South Africa all fruit intended for export is subjected to Government inspection before export is permitted. Stringent regulations prescribe the methods of inspection and types of package to be used. Standards of cleanliness and general conditions are laid down, and accurate grading, in accordance with prescribed standards, is enforced. The effect of these regulations has been that there has been a marked advance in the grading and packing of South African fruit, and this has been reflected in the increased favour which has been shown to it on the United Kingdom market in recent years.

Until recently Turkish sultanas from the Smyrna district have been graded entirely by hand. In the big stations enormous heaps of sultanas of all kinds and descriptions lie about, and any particular sample can be produced by proper selection from the different heaps. The supplies are so large, and the selection of the different crops so carefully made by hand, that the regularity of Smyrna grades is entirely relied upon by the trade. Packing was until quite recently done mainly by the feet of the workers, but now more supervision of the industry is being exercised by the Turkish Government.

In Spain packing warehouses exist in the various centres. All fruit for export from the Malaga raisin district must be submitted to the Junta Provincial de Defensa Contra la Falsification de la Pasa Moscatel before being exported. Each box must contain a printed label giving the grading and the corresponding marks. Fruit is graded and packed entirely by hand, involving a very great deal of labour. It is, however, done very well indeed—far better than would be possible by any other method.

In the United States of America the bulk of the Californian crop is controlled by the "Sun Maid Raisin Growers." This organization packs, grades, and sells the fruit. Grading and packing are carried out entirely by machinery. After the fruit has been packed in the cases it is fumigated before export. The grading of Californian dried fruit is very carefully carried out to ensure regularity of the different grades. The lowest fruit grade is not sold under the "Sun Maid" brand; it is disposed of to individual packers. The "Sun Maid" varieties are graded under 1, 2, 3, and 4 Crowns.

Transport to United Kingdom.

The ocean freight and the length of the voyage from the different centres of dried fruit production to United Kingdom are as follow:—

	Freight per ton. s.	d.	Time in Transit.
Australia (measurement)	*50	0	5 to 8 weeks.
South Africa (measurement) ..	50	0	2½ to 3 weeks.
Greece (weight)	25	0	2 to 3 weeks.
Turkey (weight)	40	0	3 weeks.
Crete (weight)	45	0	3 weeks.
Spain (weight)	†15	0	1 week.
California (via Panama) (measurement)	65	0	6 weeks.
California (overland) (weight) ..	93	4	4 weeks.

* Equivalent to 72s. 6d. per ton weight. † Plus 10 per cent.

(To be continued.)

SHERRY.*

By F. de Castella, Government Viticulturist.

Though the popularity of sherry has receded from the flood tide of its prosperity in the seventies of last century, it still retains its rank as one of the world's finest wines. The ethereal delicacy of a high-grade sherry, notwithstanding its high alcoholic strength, and the potency of its curious and very special bouquet are unexcelled among the masterpieces of the wine-maker's art. Although the second of these may somewhat overshadow the first, to the uninitiated, delicacy and refinement are indispensable in a high-grade wine. A coarse or "basto" character depreciates it more than any other taint—more even than slight unsoundness.

Sherry is a wine which may truly be classed as unique. It differs radically from all other wines, as much by the peculiar bouquet and flavour of the finished article as by the curious method of rearing by which these are developed. Among many points of interest, none is more striking or more uncommon than the part played by a fungous organism known in Spain as *flor*, which grows as a surface film on the wine during the early years of its evolution. To this organism is undoubtedly due the sherry character—that curious taste reminding of ether or, to be more correct, of aldehyde, which distinguishes sherry from all other wines. It is true that there are sherries that do not possess this character; but those usually met with in the trade almost invariably show it in more or less marked degree, for the reason that sherry, as shipped out of Spain, is nearly always a blend, into the composition of which enters a varying proportion of wine possessing this strange character.

The writer had the good fortune, during a few weeks spent in Jerez, some years ago, to be the recipient of extreme kindness from several men of very high standing in the wine trade of that town; he was thus privileged to obtain unhoped for insight into the making of this curious wine. His investigations were described in a series of articles, now out of print, which appeared some years ago in the this *Journal*. It is hoped to shortly re-issue those articles, with some additions, in bulletin form. The present paper is practically a summary of the proposed bulletin. It is hoped that this attempt to outline and briefly describe the more striking facts in connexion with sherry may prove of interest to this congress.

Sherry derives its name from the town of Jerez de la Frontera, near Cadiz, in the south of Spain, formerly spelt Xeres. The Spanish pronunciation of the initial letter being something like Sh in English, the evolution of the word sherry is explained.

Since the sixteenth century this wine has been largely shipped from Spain to England, where it was formerly known as sherris sack. We all know how Falstaff sang its praises. It gradually displaced Canary sack in public favour, and increased steadily in popularity—the Peninsula war aiding—until 1873, when over 8,000,000 gallons of sherry were shipped to England from Spain.

The sherris sack of Shakespeare's time differed radically from what we now know as sherry. It was a dark-brown wine, almost as dark as

* Paper read at the Seventh Interstate Wine Congress, Sydney, August, 1926.

stout, made by boiling down part of the must to one-third or one-quarter of its original bulk and adding this *Arrope,* as it is called, to the remainder, before or during fermentation. This continued slowly until the wine was almost dry, or, at most, only slightly sweet, distinctly bitter, and with a curious cooked—almost burnt—flavour. This queer wine has survived in the *Vino de Color* still made at the present time and used for blending in with brown sherries, in which it is the colour element.

This class of wine was superseded by more natural ones, free, or almost free, of boiled must or arrope. It no doubt varied a good deal in character and alcoholic strength, being often distinctly sweet; as witness the after-dinner or East India sherries of last century.

More recently still, a further change of fashion took place, in favour of a yet more natural wine, usually known as the *fino* type, so that at the present day the sherry in greatest demand is absolutely different to what it was 100 years, or even 40 years, ago.

It is true that sherry at the present time is a somewhat variable quantity: there are a good many different types on the market, some brown, some pale, some very dry, some distinctly fruity; but in the type most frequently met with the fino character preponderates. Sherry, as it is met with outside of Spain, is essentially a blended wine; it is a wine blended with consummate skill, and the elements which go to make up the blend are sound, pure, well-matured wines, but belonging to several distinct types. In the great majority of cases, the *fino* type predominates.

The *flor* organism, and its vital importance in developing the "sherry character," have already been referred to. This taste is not present in all the wines one meets with in Jerez—in some, indeed, it is conspicuous by its absence—but some wine possessing it in pronounced form is almost always blended into the sherries of commerce before shipment. Such wine is of *fino* type.

Sherries in their natural unblended state can be divided into two groups—those with the characteristic sherry taste and those without it. The former have always developed for some years in ullaged casks with a flor film growing on the surface of the wine. The development of the "sherry taste" is entirely due to the growth of this peculiar organism.

According to whether *flor* has been present or absent, we may class sherries in two main divisions, represented respectively by the *fino* and the *oloroso* types. Each of these, in turn, includes several sub-types. The fino type is thus a wine which in its early years was reared with a flor film on its surface, to which it owes its characteristic "ether" taste and bouquet. Now flor grows with difficulty, if at all, on wine containing more alcohol than about 26 per cent. proof. It follows that fino wines are only made from grapes vintaged at less than 14 degrees Baumé.

The oloroso type, on the contrary, consists of wines which from the completion of the first fermentation, contained too much alcohol for the flor to be able to grow. Such wines are thus made from grapes vintaged at over 14 degrees Baumé.

The *fino* type includes a good many distinct, though allied, wines; we need only here refer to the two well-known terms *Manzanilla* and *Amontillado.*

Manzanilla is a wine made at San Lucar de Barrameda, 18 miles north-west of Jerez, where the vines are grown on sandy soil. The wine is, in consequence, lighter than that grown on the chalk soils near Jerez, the grapes being vintaged at 13 degrees Baumé, and even less. It develops, nevertheless, a very pronounced fino character, though with less body than most wines of this type.

Amontillado is the second stage in the development of a wine of fino type. Under the storage conditions prevailing in the Bodages of Jerez, the wine gradually increases in strength. When this reaches a stage at which the flor film ceases to grow, the wine, if still kept under treatment, enters on the second stage of its evolution and is becoming amontillado. The term really means "like Montilla," the name of a town where the special Solera method of rearing had been followed long before it was adopted in Jerez.

The transformation from fino to amontillado is gradual; the "ether" taste of the fino eventually gives place to a peculiar "bite" or sharpness, akin to bitterness well known to connoisseurs of sherry. It takes from twelve to twenty years from vintage before the wine can become amontillado. For a few years after the disappearance of flor it is an amontillado fino, finally reaching the complete amontillado character when it is a *vino hecho*—a made wine.

There is even a third stage by which the amontillado develops into a *vino vicjo* (old wine), becoming stronger in alcohol, darker in colour, and usually distinctly bitter. Such wines are rare and of very considerable value for blending.

Oloroso wines, owing to their alcohol strength, develop without flor on the surface. They are thus quite distinct from what one is accustomed to look for in a sherry. They are full-bodied, unctuous, full-flavoured wines, though, in their unblended state, free from sugar. When old, they are brown and somewhat bitter; some very old olorosos are as brown as stout and almost unpleasantly bitter, but of great value for blending.

It is curious that a very old oloroso and a vino viejo—the final stage of the fino-amontillado chain—resemble one another a good deal, both being brown and bitter; a similarity which is the more remarkable in view of the striking difference that existed between them some years earlier.

Other types of sherry include *vino de color*, made on similar lines to the sherris sack of former days and, like it, brown, rather bitter, but almost dry. *Pedro Ximenez* is a very luscious, sweet wine, made from grapes of that well-known variety, artificially ripened in the sun on esparto-grass mats, until the must registers about 20 degrees Baumé. It ferments but little, and, after fortification, has a gravity of some 12 degrees to 13 degrees. It is sold as a liqueur, and also for sweetening trade sherries. *Paxarete* is more or less intermediate between the two last; it is made from artificially over-ripened Pedro Ximenez, a little arrope (boiled must) being added.

These distinct wines are the ingredients with which the skilled cellarman makes up the sherry of commerce. It is blended, fortified, to the desired strength—usually 33 per cent. proof—fined or filtered, and shipped.

Whether the wine be fino or oloroso—Manzanilla or Amontillado—it is invariably matured on the solera method. Soleras containing fino wines develop with a flor film on the surface; those containing Olorosos and Amontillados develop without flor.

Before describing the Solera method, the soil, vine sorts and actual making of the wine must be rapidly outlined.

The geological formation of the Jerez district is Tertiary limestone of Miocene age. The white chalky marls of the *Afuera* or *Albariza* type, containing, in some cases, up to 80 per cent. of carbonate of lime, yield the choicest wines. Near the town some vineyards are situated on *Barros* or clay soils, whilst the Manzanillas of San Lucar are grown on sand. High lime content is the chief characteristic of the soils which yield sherry.

The vine sort chiefly grown is the Palomino or Listan, for it is known by both names. This is undoubtedly the vine we know in Australia as Sweet Water: the identity of the two has been proved beyond question by importations made in 1908 and later. The similarity of the two was already commented on by Dr. Kelly in his well-known book, and by the late Thomas Hardy in 1885. Sherry differs from Port in being practically a "one variety" vine. Nine-tenths of the best vineyards are planted with Palomino. Other sorts cultivated in small proportion are Mantuo Castellano, Mantuo de Pilas, Albillo, Mollar, Perruno, and Canocazo; Pedro Ximenez is also grown, but it is converted after artificial ripening on esparto mats, into the exceedingly sweet liquorous wine of that name.

Vintage takes place about the end of September, the gravity of the must varying between 12½ and 16 degrees Baumé. The grapes crushed under 14 degrees Baume usually result in fino wines; over 15 degree Baumé in Olorosos. The destiny of the wines is, however, decided at the classifying in early winter, in the town Bodegas, where the wines are reared, and not at vintage time.

Before crushing, the grapes are usually exposed to the sun on Esparto mats, spread on the ground in the *Almijar,* an open court yard adjoining the *Casa de Lagares,* or press house. For wines of fino type exposure only lasts a few hours, for Olorosos a couple of days, whilst for the sweet Pedro Ximenez it may be necessary to prolong it for nearly a fortnight.

Avoidance of tannin, in the greatest measure possible, is a marked feature of the wine-making method. Grapes fermented, even to a slight extent, in contact withe the skins, yield a basto wine, quite useless to the sherry rearer.

The grapes are crushed by trampling with the feet, and pressed rapidly and rather incompletely for the first grade wine. The marc is re-handled and treated with water to extract the remaining juice in the shape of *Piquettes* or *Agua Pies* for distillation and domestic use.

Neither grapes nor must are sulphited or sulphured in any way, both SO_2 and tannin are undesirable, since they interfere with the normal growth of flor.

Another remarkable feature is the plastering of the grapes during crushing, a general practice, said to be essential to the subsequent

development of flor. Burnt *Yeso* or Gypsum, which abounds in the neighbourhood, is dusted over the grapes on the press or Lagar by the men who trample on them, at the rate of 12 to 15 lb. per ton of grapes. Owing to rapid pressing and short contact, the yeso is only partially acted on, and the resulting wine contains only two or three grammes per litre of potassium sulphate, and often less; a smaller proportion than if fermented on the skins with this quantity of plaster.

The salient features of the vintage at Jerez are thus the use of plaster and the avoidance of SO_2 and of tannin. Cleanness and delicacy are essential. The basto taint is greatest dread of the sherry maker.

Fermentation takes place in butts of a little over 100 gallons capacity. These are, as a rule, immediately carted into the Bodegas in Jerez, where subsequent rearing is conducted. They often remain in the open air until the end of November, when they are classified and racked. At this stage the differences to be noted between the wines in the different butts are truly remarkable: no two are exactly alike, and in many cases variations are so extreme that it is difficult to credit that they are the produce of the same vineyard and same grape variety.

The classification or drafting of these young wines, which are still on their lees in the butts in which they were carted, is a most interesting operation. They are sorted into groups, each of which will undergo different treatment, and have a distinct type of wine as its objective. "*San Andrès mosto vino es*" says the proverb. In other words, by St. Andrews' Day (30th November) the must is wine, and it is usually in early December that the young wines are classed, each butt receiving a chalk mark indicating its character. Faulty wines are, of course, eliminated for distillation, being marked as *Parillas* with double cross lines much as we do here. This term, which signifies gridiron, refers to the bars of the fire box under the still.

The sound wines are classed as *Palma, Cortados* and *Rayas.*

The Palmas form the basis of the fino type, and are therefore the most generally useful for the sherries of to-day. They are fairly light wines, which have finished their fermentation rapidly and completely. they are of pale colour, and chiefly remarkable for delicacy, refinement and low acidity. The alcohol strength varies between 23 and 25½ per cent. proof, though some wines are even lighter. A palma is a complete surprise to the visitor, being about as different from the finished wine as it is possible to imagine. It is far more like a young wine of Chablis type though less acid. The palmas constitute the cream of the lighter wines.

The Cortados are bigger wines, and are the basis of the oloroso type—one has no difficulty in realizing that they will develop into sherry. They are well fermented, almost, if not quite dry, show considerable distinction as well as body, and contain about 27 degrees proof. They are thus too alcoholic for fino soleras and for the growth of flor. *Palo cortado*, literally signifying notched or cut stick, is the sign given to most of these, but extra special wines are deemed worthy of an extra notch or even two. We thus have *dos Cortado* and *tres Cortado;* rare wines, which are expected to develop into something very special.

The rayas are a rather indeterminate group; their destination is not immediately apparent. Raya simply means a chalk mark or line. The wine is given one, two, or three marks, in descending order of quality. These are wines which are less advanced than the others. One raya is usually a wine, not delicate enough for a palma and not big enough for a palo cortado—a wine without marked qualities of faults: it may develop into something better, but it is premature to decide what will be done with it. Two rayas is assigned to a wine which is somewhat less satisfactory: it may even tend to coarseness or basto. A three rayas is even worse, and may ultimately find its way to the still.

I was privileged to assist at one of these classifications. I was chiefly surprised at the lightness of the palma type, also to see several wines which were sound, though coarse, sent to the still; wines which some of our cellarmen might describe as "the makings of a good sherry." These wines were basto and of no use for sherry. Coarseness is, in fact, more feared than slight acetification.

The disposal of the young wines after they have been classified, varies according to circumstances. They may go at once into a solera, but more usually they are racked and kept separate for a few months before doing so. In some cases they may indeed remain for a year or more as an *Anada*, i.e., a vintage wine, before finding their proper place. This is the general rule in the case of rayas.

At the December racking the lighter wines are slightly fortified; those under 25½ per cent. proof being brought to this standard, a strength sufficient to afford reasonable protection against acetification without hindering the growth of *flor*.

The spirit used in Jerez, both at this stage and subsequently, when the wine is shipped, is highly rectified wine spirit of a strength of 60 degrees over proof. It thus differs altogether from the spirit used on the Douro for the fortification of Port.*

The Solera system must now be described. We are reaching the most interesting part of the history of Sherry: the practical utilization of the flor film, which is rendered possible by the solera system of rearing. Without this system it is, indeed, doubtful if sherry could have been regularly produced. The growth of flor on individual casks would no doubt be possible, with the resultant development of the special character for which it is responsible, but its regular commercial utilization and particularly its maintenance on the surface for a sufficient time to achieve a complete result, would be problematical and hazardous.

A solera is a series of butts of Sherry in process of maturation or rearing, so arranged as to provide for progressive fractional blending. It is divided into a varying number of stages; from the final stage is withdrawn the finished wine, whilst young wine is introduced into the earliest stage.

Let us suppose, for the sake of illustration, a solera of 50 butts divided into five stages, each containing ten butts. The butts are of 115 gallons capacity, but as they are always a little ullaged, their net

* Port is fortified with wine spirit distilled at about 40 per cent. overproof. It retains much of the flavour of the grape. It is thus similar to a young brandy and very different from the neutral spirit used in Jerez.

content would be about 100 gallons. This solera has been functioning for many years; when first established each stage probably represented a particular vintage, but with continual replenishing these have long since lost their original significance.

Stage I. contains the oldest wine: from it the finished wine is withdrawn, but in doing so the butts are only partially emptied, not more than one half being removed in any one year. Withdrawal is usually made twice a year, 25 gallons being removed on each occasion. The voids in the butts of stage I. are immediately replenished from stage II., which in its turn is replenished from stage III., and so on. Stage V. is replenished with young wine or with wine kept as an Anada for a year or even longer. The usual age is a few months.

The wine thus moves steadily forward through the different stages until its final withdrawal, when it is a complex blend, none of it being less than 5½ years old, but containing in varying proportion, still older wine, including very small quantities of every wine that has gone into the solera since its first establishment.

A solera on the above lines would only yield 500 gallons of finished wine each year, from a stock of 5,000 gallons. Interest and loss by evaporation render it impossible for a solera wine to be reared at a cheap price. Nor is the above an extreme example. Soleras differ in the number of their stages. For the rapidly developing Manzanillas of San Lucar, three or four stages is the rule. Five or six stages are frequently in fino soleras at Jerez, though some consist of eight or nine, turning out, as might be expected, very expensive wines.

The butts of a solera are never emptied, nor are they ever quite filled, the ullage is usually about one-eighth of the capacity of the butt. In the case of Fino Soleras, during the whole of its sojourn in them the surface of the wine is entirely covered with a flor film. Special care is taken when withdrawing and replenishing to disturb neither surface film nor less.

The solera system is something of an innovation in Jerez; it was not followed there 70 or 80 years ago when the demand was for Olorosos and similar wines. It has been in use since very remote times, at San Lucar (Manzanilla) and at Montilla, about 100 miles N.E. of Jerez. Its adoption at the latter place is the outcome of a change of fashion in favour of a paler and drier wine of fino type, which set in less than a century ago. Though it finds its greatest utility in connexion with fino wines, it is now generally applied to all types. Oloroso and Amontillado Soleras, owing to their strength, have no flor on the surface of the wine; with these the merit lies in the automatic blending and uniformity of product the system assures.

In addition to the above, composite soleras are to be met with, destined for the production of special wines of very high price. One of these might be termed a solera of soleras, the youngest stage being replenished with a blend of finished wines from other soleras; such complex soleras comprise very few stages.

The fino soleras are certainly the most interesting. In these the flor completely covers the surface; a healthy film is white and often wrinkled, there are no bare patches where the surface of the wine is exposed. Provided this is so, all goes well, the wine is protected from

acetification, both by the film organism, as Pasteur explained long ago, and by the atmosphere of carbon di-oxide it develops in the ullage of the butt.

Success depends on the healthy growth of the flor; should this languish, there is danger. As was explained to me in one of the leading Bodegas, Sherry, during its flor stage, is working out its destiny on the borderland of the vinegar country.

In Jerez there seems to be little trouble in establishing a healthy film, and once established its maintenance seems easy. No doubt taught by long experience, no wine goes into a solera unless altogether suited to its growth, its suitability being gauged by what the French term "Organoleptic" analysis rather than by chemical examination.

Let us briefly consider the chief features of a wine suited to flor growth.

Its alcoholic strength must be under 26 per cent. proof. We have seen that the young wines going into a solera are fortified to 25½ per cent., if of lower strength. Lighter wines are certainly used at San Lucar for Manzanilla soleras.

It must not be too high in acid. Samples of solera wines secured by the writer averaged only .4 per cent. of acid (as tartaric). Pasteur has shown that the acetic ferment needs a fairly acid medium for its healthy growth; conversely, to avoid acetic trouble, low acidity is desirable. It is noteworthy that our so-called Australian sherries are much more acid than the wines of Jerez.

It must be almost free from tannin, and from SO_2, both of which seem to inhibit flor growth.

Lastly it must possess a sufficiency of plant food substances, other than alcohol and tartar. Its close relationship with yeast would indicate that flor takes its nitrogen most readily in ammoniacal form. In experimental cultures the writer has found the addition of seven centigrammes per litre (1 oz. per 100 gallons) of ammonium phosphate to have a decided beneficial effect. In Jerez the addition of plaster or yeso to the grapes when they are crushed, is held to play a considerable part in rendering the wine suitable for subsequent flor growth.

Exposure to air is not considerable. The butts are ullaged to at most one-eigth of their capacity, but air is not freely admitted. Though not tightly bunged, they are closed with large corks, fitting fairly closely.

Concerning the actual nature of the flor organism we know little. It certainly merits complete investigation. Under the microscope it appears to be identical with ordinary flowers of wine, *Mycoderma Vini*. The latter does not, however, develop the sherry character, it merely communicates flatness to the wine on which it grows. Is the flor fungus a wild yeast or a special form of *Mycoderma Vini*? Pastuer admits that there are several varieties of it? The question remains unanswered, but the action of this organism on the wine is none the less potent and unmistakable.

We now come to the final stage, viz., blending and fortification to prepare the wine for shipment. The pure type wines, withdrawn from the final stages of Soleras, are very seldom shipped as such, though it may, and does occasionally happen that a special customer may fancy one of these. They are, however, very different from the sherry to be met with outside of Spain, being absolutely dry and of somewhat lower alcohol strength.

The Sherry of commerce is always a blended wine. Though the demand is now chiefly for the fino type, this is usually more or less modified by a certain proportion of Oloroso, Amontillado, or one of the composite Soleras, sometimes by all three. Fruitiness is communicated by the admixture of a small quantity of very sweet wine, either Pedro Ximenez or Pajarete, and if the colour needs intensifying, recourse is had to vino de color. The alcohol strength is also increased, since the wines in the soleras—especially in the fino ones—are kept at a fairly low strength. Though Manzanillas and a few lighter finos are shipped below 30 per cent. proof, the usual strength of Sherry is about 33 per cent. The wine is brought up to the required standard with highly rectified wine spirit of a strength of 65 over proof and it is *Bonificado* or fined.

There is no such thing as a standard blend. The greatest complexity prevails, rarely do two lots of Sherry go out exactly alike. Each customer wants his own particular wine, usually a "repeat" of a previous order. Complaints are frequent concerning the exactions of customers in this respect. The final blend reminds one, a good deal, of the making up of a prescription by a chemist. So many *arrobas* each of, may be, half a dozen solera wines, a little pedro Ximenez and colour and the spirit needed to bring up the strength. The cellar book supplies the formula of the order to be repeated and the sample room, which is a feature of every important Bodega, enables the small trial blend, in a graduated glass measure, to be checked and modified slightly if need be.

So far we have only considered wines of very high grade—blends consisting entirely of solera wines. Such are necessarily costly: at the time of my visit the cheapest of these could not be shipped for less than £50 per butt, whilst the output of soleras, consisting of many stages, cost considerably more. Pure Amontillados were worth £100 per butt and over. There is a big trade demand for cheaper sherries, and this is supplied by blends of a varying quantity of solera wine, broken down with cheaper wine from the surrounding districts of Moguer, Arcos, Huelva, Seville, and even Valdepenas and Manzanares. Blending is here a fine art, and there is probably no wine where quality is more exactly adjusted to price than in the case of sherry. Samples at the same figure from any of the leading Bodegas of Jerez show wonderfully little variation in quality or real value. According to the price the purchaser is prepared to pay, he will get a wine wholly reared in soleras or a blend of this with cheaper wine.

Such is a necessarily brief outline of the making and rearing of sherry. Whilst the several factors of soil, climate and vine variety each play parts of importance, this wine owes its remarkable and very special character in far greater measure to the unique method of rearing in soleras, and to the development of the flor organism, growing as a film on the surface of the wine, which this method renders possible. In order to produce wine of similar type, the solera method must be followed in its entirety and not in a partial or spasmodic way. A healthy and active growth of flor is essential; this is assured by due attention to the composition of the wine to be reared, in the directions of suitable alcohol content, low acidity, sufficiency of yeast food, and freedom from all but a trace of tannin and sulphur di-oxide. The wine must also be free from any suspicion of coarseness.

WHEAT BREEDING.

HOW NEW VARIETIES ARE PRODUCED.

An Address by George S. Gordon, Cerealist, State Research Farm, broadcast through 3LO.

In my endeavour to explain how new varieties of wheat are produced, it will not be possible, in a limited time, to deal fully with such a large subject, nor to go into many aspects of the work which should really be dealt with in order to place plant breeding in relation to agriculture in true perspective.

In agriculture, as in any other business, economical production is one of the essential factors of success, and in my opinion the production of improved varieties of cereals is one of the quickest and most economical methods of increasing the crop yield of the State.

In support of this statement, may I quote the Government Statist's estimate that in Victoria last year there were somewhere about two and a half million acres sown with wheat for grain. Assuming that by means of more prolific, more drought- and disease-resistant varieties, the yield from this area could have been increased by only 1 bushel per acre, at current market rates an additional amount of approximately three-quarters of a million sterling would have been received by the wheat-growers of the State. And this without a single *extra* acre having been cultivated, manured, seeded, or harvested! Eventually the additional money received by the farmers would have been distributed through the other sections of the community. Thus it will be seen that all benefit, either directly or indirectly, by the increased production of crops which can be exported at a profit.

Coming now to the methods by which new varieties of wheat can be obtained, and assuming that "new" varieties refer to those which are new to Victoria, there are three main lines of action—

First. The introduction of improved varieties from other parts of the world.

Second. Selection of superior (and sometimes variant) plants from existing varieties.

Third. Cross-breeding.

In order to obtain some idea of the relative value of these methods as a means of producing improved new varieties, let us commence by analysing the history of the twenty varieties which, according to the Government Statist, are most extensively grown in Victoria.

In passing, it may be of interest to you to know that there were about 120 varieties of wheat grown by Victorian farmers last year. This imposing list was headed, of course, by Federation, the raising of which was the achievement of the late William J. Farrer, of New South Wales, which is credited with having been sown on 43 per cent. of the total area under wheat. Most of the varieties, however, were grown in comparatively limited areas, but the number indicates the interest which farmers take in different varieties, for many of them are not of much general utility.

According to the Government Statist, the twenty leading varieties of the State are the following. They are given in order of popularity, and that popularity is determined by the acreage sown to each:—

Federation, Currawa, Major, Yandilla King, Penny, Bald Early, Gluyas, Mac's White, Huf's Imperial, Dollar, Turvey, Minister, Joffre, Dart's Imperial, Rajah, Wannon, Gallipoli, College Purple, Warden, and Rance.

Many of these wheats have come into general cultivation during the past ten or fifteen years, and they may, therefore, be said to be comparatively "new" as well as popular.

An investigation of their history reveals that they have originated as follows:—

	No. of Varieties.
First. By introduction from overseas	1
Second. By introduction from other States (two cross-breds and two selections)	4
Third. By pedigree selections made in Victoria ..	4
Fourth. By cross-breeding carried out in Victoria ..	11

From these figures you will see that nineteen out of the twenty leading varieties have actually been bred in the Commonwealth, the exception being Mac's White, which is said to have been brought from New Zealand, and is now extensively grown in the Mallee. Four were introduced from other States, and no less than fifteen were bred in Victoria. Of these fifteen Victorian-bred wheats, eleven were produced by cross-breeding and four by selection. Seven of the eleven crossbreds were raised by Mr. Hugh Pye, Cerealist at the Dookie Agricultural College. Currawa and Major, two of the varieties which Mr. Pye has given to wheat-growers, are second only to Federation in popularity, while his Warden is recognized as the best hay variety in cultivation.

I may again summarize the history of the best twenty wheats by saying that only one variety was introduced from overseas, six were produced by individual plant selection, and thirteen by cross-breeding.

From this analysis of the wheats, which by merit have already won their way to the hearts—by way of the pockets—of growers, we may conclude that in the production of new varieties to suit our climatic, soil, and other conditions, the most satisfactory results have been achieved by crossbreeding, with pedigree or individual selections second, and introductions from overseas a rather poor third.

Returning to the three avenues of crop improvement, namely, introduction, selection, and cross-breeding, I will briefly describe the vast amount of work—combined with many disappointments, fortunately relieved by a few pleasant surprises and a little success—which the improvement of our cereal crops involves at the State Research Farm, Werribee.

Varieties Introduced from Overseas.

The Department is always ready to avail itself of opportunities to try out varieties from outside sources, and often obtains seed of new types by exchanging seed of our own wheats for that of other countries.

In order to avoid introducing with the new varieties new diseases or pests, each packet of imported seed is examined by the Plant Pathologist for evidence of disease, insect pests, weed seeds, &c. The

seed is then fumigated and forwarded to the farm for sowing. There it is pickled and sown in a quarantine area isolated as far as practicable from similar crops. For several years the imported varieties are grown under observation and in competition with check plots of, say, Federation, and, as they become acclimatized, they generally improve in appearance and yield.

We have already seen that varieties obtained from overseas have not given very encouraging results to date. Those from the Old World are usually too "flaggy," too late in ripening, and require a longer growing period, cooler conditions, and more abundant rainfall than the average season in the wheat-growing districts of Victoria provides. Nor do the famous high-strength red wheats such as Marquis, which yields so well in Canada, come up to expectations. Many of the introduced varieties, however, bear good reputations for prolificacy, disease resistance, and other valuable characters which make them of interest and value to the plant-breeder. By cross-breeding, these desirable characters may be combined with the good qualities of the best Australian wheats, with the result that new varieties, superior to both parents, are produced.

This is well illustrated by the results from crosses between Indian and Australian wheats. Though not themselves sufficiently good to warrant extensive cultivation, the most useful introductions from overseas during recent years have been obtained from India. Some of these wheats carried such desirable characters as earliness and strength of straw, combined with fair prolificacy and disease resistance.

By crossing these with Australian wheats several very promising new varieties have recently been bred. These comprise Rajah, Ranee, Nizam, Sepoy, Ghurka, Mogul, and Omrah, and though they bear Indian names, given because in each case one of the parent wheats came from India, they are all Victorian-bred wheats which have been produced by crossing Indian types with proved Australian varieties.

Improvement Effected by Selection.

There are two general methods of selection in use—first, mass selection, which is generally used to maintain and improve the prolificacy and purity of existing varieties, rather than for the production of new types; and, second, individual or pedigree selection.

In the latter case, individual plants are selected, and the seed of each plant is sown in separate rows. This enables a strict comparison to be made of the progeny of each selection, so that in a few years the best strain in the original selections may be determined and multiplied for more extensive use. Thus, strains varying only in their degree of prolificacy may be isolated. It sometimes happens that outstanding variant plants are found in the crop. These may differ in regard to appearance, structure, colour, and other characters, compared with the *great majority* of the plants in the crop. The variant plants may be either the result of natural crosses with other varieties or what are termed "mutations." Seeing that natural crosses are extremely rare in wheat, they are usually "mutations."

"Mutations" are frequently reversions, or plants which are said to have "thrown back" to the character or characters of some of the ancestors of the particular variety under observation. They are commonly known as "sports," and little is really known regarding the cause of their appearance.

A feature of these "mutations" or "sports" is that they generally breed true to type, and, therefore, if valuable, may be multiplied and brought into general cultivation fairly rapidly.

You will remember that six out of the twenty best Victorian wheats were produced in this way. These wheats are—

Penny. } (Selections introduced from other States.)
Gluyas. }

Turvey. } (Selections made in Victoria.)
Dart's Imperial. }

These four bear the names of the farmers who selected them.

Dollar. } Both selections from Federation, made in Victoria. Dollar by Mr. Muller, of Nhill; and Wannon by Mr. Ivan Tulloh, who is now Farm Manager at the Longerenong Agricultural College.
Wannon. }

At the Research Farm, we not only try to produce better *new* varieties, but also endeavour to maintain and improve the high standard of existing varieties. Thousands of plants are selected from the various plots for testing each year, and the produce of those which promise well in the smaller plots are promoted to larger areas as the seasons go by. After surviving the field tests for a few years, the new wheats are then tried out at other farms and in the experimental areas throughout the State.

For instance, in the departmental tests in the wheat-growing districts we are this year, for the first time, trying out improved selections of Federation, Rajah, and Rance. In field plot competition with the best ordinary selected strain of the varieties mentioned, the new selections have averaged the following increased yields at Werribee:—

Over a period of four years, covering seven tests, a special selection of Federation gave an average annual increase of 2.2 bushels per acre over the ordinary selected strain.

A new strain of Rajah during two years, covering three tests, gave an average increase of 2.5 bushels per acre over the original strain.

A new Rance selection over a period of three years, covering five tests, yielded an average annual increase of 3.2 bushels per acre above the ordinary Rance.

Seeing that Federation, Rajah, and Rance are already numbered amongst the twenty "elite," there is little doubt that growers will watch these new strains with keen interest, and it is hoped that in their new locations they will continue to give increased yields, as in the past they have done at Werribee.

In disseminating information regarding the behaviour of new wheats such as these, the agricultural press plays a very important part, and I would like to refer to the great loss which cereal growers have sustained by the recent death of Mr. G. A. Sinclair, who wrote under the pen-name "Hickory" in the Yeoman columns of the *Australasian*, and kept growers well posted regarding new varieties. The late Mr. Sinclair was always keenly interested in varieties likely to "lift" the grain production of the State, and kept in touch, not only with the work at the experiment stations, but also with the behaviour of varieties when the seed was distributed to growers. I feel sure that there are many who, like myself, miss his genial personality and sound advice.

Crossbreeding.

Coming now to the most important method of producing new varieties —crossbreeding—we can say that this method provides a sure and certain means of improvement, for by crossbreeding the desirable characters of several types can be combined in one new variety.

In plant selection work we examine the ordinary crop for the appearance of plants of outstanding merit in regard to prolificacy, disease resistance, early maturity, vigour, structure, &c.; but by the application of a knowledge of Mendel's Law of Inheritance, plants combining many of the desired characters can actually be produced by crossbreeding. Crossbreeding causes the unit characters contained in the constitution of the parents to split up and re-combine in various ways, just as cross-bred live stock vary from the typical appearance of pure-bred animals. Thus crossbreeding provides a means of breaking the type, and in the re-combination or segregation of characters, which occurs in the plants of the second generation, we are sure of a great variety of new types from which to select the plants we desire.

Conclusion.

Time will not permit of a description of how the crossing is done, but, seeing that most people are interested in this section of the work, I hope to have the opportunity of telling you about it at some future date.

I have tried to avoid wearying you with figures, but, in conclusion, would like to indicate the scope of the work by saying that at the State Research Farm alone we have sown this year well over 3,000 plots solely devoted to the improvement of cereals. Approximately, 2,500 of these are new crossbreds and selections combined with the best standard varieties for crossing and other purposes, which are grown in an area of 10 acres, known as the Stud Cereal Field.

When the new varieties are fixed, or, in other words, breed true to type, and the yield warrants, they are promoted to larger plots, called long rows. These are rows 5 chains long, sown with the drill.

The next stage is the "selection" plots, where the best standard varieties, crossbreds, and selections are grown in field plots, an area of one-fortieth of an acre being given to each.

Those winning through this test are promoted to the field "variety" plots of a quarter of an acre each.

The survivors of the "variety" plot tests are, in turn, promoted to the "seed" plots of from 1 to 3 acres each. These "seed" plots include the standard varieties (such as Federation), which are grown for distribution, and the cream of the new wheats, which, by the time they reach this stage, are also being tried out at other State farms and departmental plots.

Finally, the "seed" plots provide the grain for the bulk areas sown for the production of seed for distribution to farmers.

In all these stages the wheats are grown in competition with check plots of Federation and Yandilla King, which are sown alternately in every tenth plot of each group. The plots are also carefully examined for purity and trueness to type, and all "strangers," or foreign plants, removed by hand picking each year.

The competition, or "struggle for existence" amongst the varieties is, perhaps, better shown by quoting the number of plots carried in each group this year.

Commencing with the 2,500 plots in the stud cereal field, the numbers are gradually reduced, as follow:—

In the long rows, the numbers are reduced to 300. In the "selection" plots, 100 survive. In the "variety" plots the number is lowered to 42; and in the "seed" plots only 26 are carried on; while, finally, the number of varieties being grown in "bulk" areas for distribution is only nine.

That the surviving wheats really are superior is proved by the fact that over 80,000 acres were sown in Victoria last year with Werribee-bred wheats; that the demand for seed of at least three of the varieties —Free Gallipoli, Rajah, and Rance—far exceeds the supply; and that one of the new wheats—Rajah—was selected by a conference of representative Mallee farmers as one of five of the best wheats for the Mallee.

COLD OIL EMULSION.

FOR SPRAYING FRUIT TREES.

By A. A. Hammond, Senior Orchard Supervisor, Horticultural Division.

An emulsion of petroleum oils can be made with sulphate of copper and lime without heating and without the use of soap.

Crude residual oil, kerosene, or cheap lubricating oil will make good emulsions. For woolly aphis, the crude oil is a cheap and effective spray. For the destruction of scale insects and the eggs of aphides, either kerosene or lubricating oil should be used.

When a combined insecticide, fungicide, and ovicide is required, the stock emulsion of the last-mentioned oils should be added to standard Bordeaux mixture, with which it readily mixes. The formula given below is for a dormant spray, and it is not advisable to use it later than the pink-bud stage on apricots and peaches.

Materials.

4 gallons unprepared red oil (lubricating oil).
3 gallons of 3 per cent. bluestone solution.
1 gallon 10 per cent. milk of lime.
Water or Bordeaux to make 80 gallons.

Directions for Preparing Emulsion.

Place oil in vessel holding, say, 10 gallons. Add bluestone solution, then milk of lime. Stir and pour into power-spraying vat. Start engine, and force mixture through nozzles back into original container at a pressure not less than 150. Sufficient pressure to make a good emulsion can be obtained with a hand-power pump.

Note.—1 lb. of bluestone dissolved in approximately 3 gallons of water makes a 3 per cent. solution.

1 lb. of fresh lime in 1 gallon of water gives a 10 per cent. milk of lime solution.

Should crude oil or kerosene be substituted for lubricating oil, 5 gallons (instead of 4) to 80 gallons of water is recommended.

A good emulsion can be made with a considerable variation of the quantities as given above.

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It thrives well on rich or poor land; either on flats or hills.
It will remain green when every other fodder is burnt up, and is quite permanent, and when established does not die out.
It grows practically throughout the whole year, giving most herbage in Spring.
It is a superior fodder, and all kinds of stock are fond of it, on which they thrive; but it is particularly suitable for sheep.
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Ether Extract	..	2.80	Ash	.. ..	17.65

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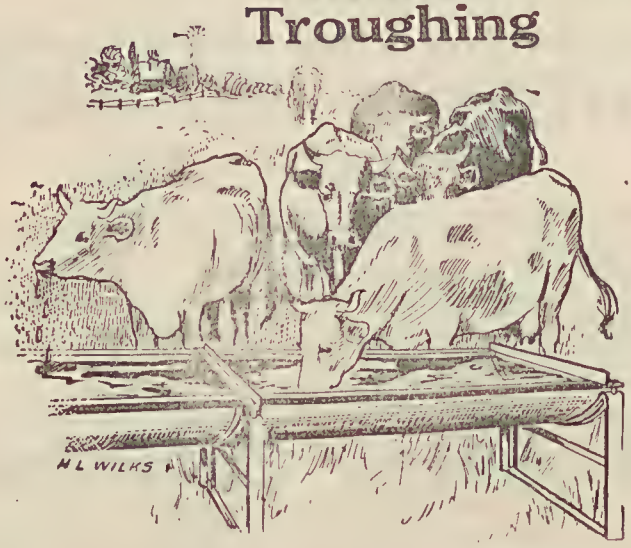

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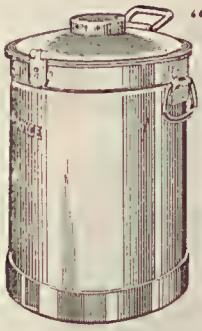

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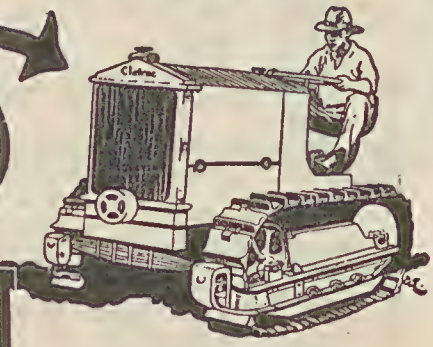

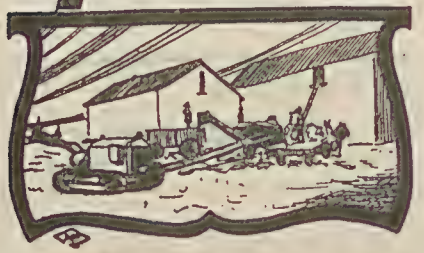

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The wise Farmer is the one who purchases his "Cletrac" NOW. By so doing he will ensure early delivery, and will have plenty of time to get familiar with it before harvest.

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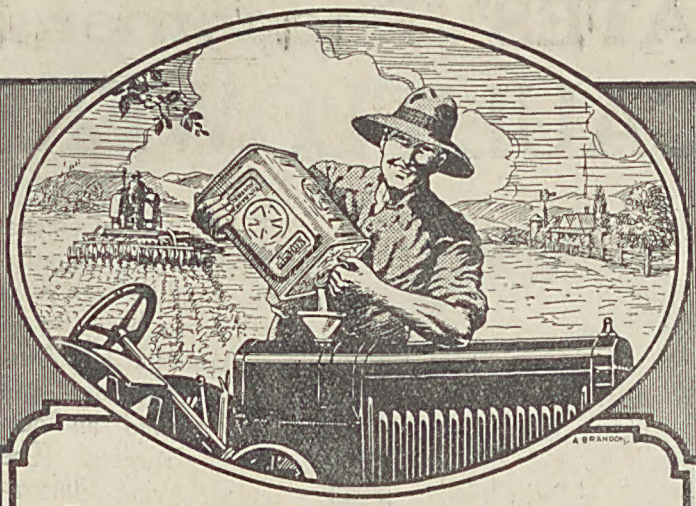

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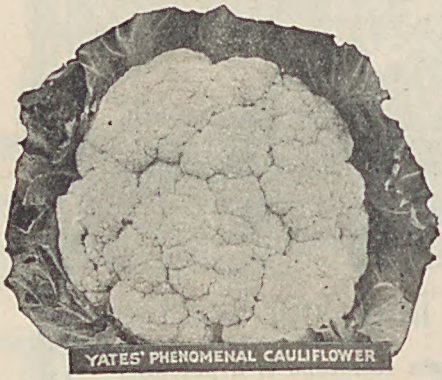
YATES' "Phenomenal" CAULIFLOWERS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THE Phenomenal Cauliflowers, introduced only a few years ago, were bred by us in Australia for Australian conditions, and have proved an outstanding success. The accompanying illustration shows the fine texture, solidity, and pure white colour of the flower. They have proved to be remarkably sure headers in our variable climate, and have an ability to recover after a check which is, we think, unequalled by any other variety. Phenomenal Early has pointed foliage—rather curled and open, and matures in about four months. Phenomenal Maincrop has the self-protecting habit, matures in about six months, and is a hardy sort of the finest quality. Both these varieties are grown and selected on our Tasmanian Seed Farm under special supervision.

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We are expecting a heavy demand, and advise early orders.

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DEPARTMENT OF AGRICULTURE, VICTORIA

Red Poll Dairy Herd

The Department has now completed the orders for calves that were booked ahead of calving when the advertisement was withdrawn; consequently the booking of orders for bull calves from the forthcoming calvings has now been resumed.

BULL CALVES are sold for delivery at a month old at prices based approximately on the actual milk and butter fat record of the dam at the rate of 1s. per lb. of butter *fat* yielded. Thus a calf from a cow with a 400 lb. butter fat record is sold for 20 guineas, one from a 300 lb. butter fat cow for 15 guineas, and so on. Bull Calves ex heifers on their first calf are sold for a set price of 10 guineas.

(For Record of Yields of dams see Red Poll Herd Book.)

SIRES IN USE:

VICTORIA VOLCANO (322 A.)

Sire: Nicotine (69 A.A.) by Acton Dewstone (imp.) 9524 (4 A.A.).
Dam: Tonga (253 A.) by Honingham Archbishop (imp.) 9702 (48 A.A.).

Tonga's butter fat yields for 6 successive lactation periods are as follow:—1916, 341 lb.; 1917, 398 lb.; 1918, 419 lb.; 1919, 479 lb.; 1920, 428 lb.; 1921, 562 lb.

BELLIGERENT (Imported) 11096 (8 A.A.)

	Dam's Record (1st milking) 7144 lb. milk.								
Dam's	Dam's	,,	14533 lb. milk	...	4	years	average	12871 lb. milk.	
Sire's	Dam's	,,	10370	,,	... 7	,,	,,	9354	,,
Sire's D.	Dam's	,,	9510	,,	... 12	,,	,,	8033	,,
G. Sire's D.	Dam's	,,	10215	,,	... 7	,,	,,	9386	,,
G.G. Sire's D.	Dam's	,,	12565	,,	... 10	,,	,,	8853	,,
G.G.G. Sire's D.	Dam's	,,	10088	,,	... 2	,,	,,	9754	,,

BIT O' 'BACCA (Vol. 3)

Sire: Nicotine (69 A.A.) by Acton Dewstone (imp.) 9524 (4 A.A.).
Dam: Nictitana (311 B.) by Nicotine (69 A.A.).

Nictitana's butter fat records for 6 successive lactation periods are as follow:—1918, 450 lb.; 1919, 396 lb.; 1920, 393 lb.; 1921, 465 lb.; 1922, 524 lb.; 1923, 536 lb.

Inspection of the Herd is Invited.

Visitors will be met at the Station on notifying the Manager, State Research Farm, Werribee.

Application for purchase to

Dr. S. S. CAMERON, DIRECTOR OF AGRICULTURE, MELBOURNE.

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